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ABSTRACT

This book contains the opening address, 2 forums, 3 symposia, 10 roundtables, 6 workshops, 18 discussion summaries, 9 miscellaneous reports, overview of home groups, preparation for home group facilitator, call to action, proposal for GASA 8, and 4 appendices. GASAT (Gender and Science and Technology) provides a forum for individuals and organizations concerned about the inclusion of girls and women in the world of science and technology, from early childhood to work environments. The program of GASAT 7 focused on four major themes: (1) recruitment and retention of girls and women in science, engineering and technology; (2) developing a feminist perspective on science that recognizes the diversity of experiences of women, girls and indigenous peoples; (3) creating a more inviting climate for work and study and developing strategies for change; and (4) gender-sensitive science, engineering and technology curricula. (MKR)

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Transforming Science and Technology:
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Volume 3: Proceedings and Contributions of the International Gender and Science Technology Conference
(7th, Waterloo, Ontario, Canada, July 31-August 5, 1993) =

Transformer les sciences et la technologie:
notre avenir en depend. .
Volume 3: Les Actes de la septieme conference internationale sur l'equite des sexes en sciences et en technologie (du 31 juillet au 5 aout 1993).

Sharon Haggerty, Ed.
Ann Holmes, Ed.

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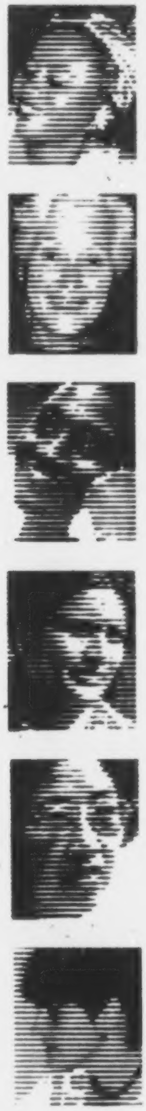

Transforming
Science
And Technology:
Our Future
Depends On It

Volume 3
Les Actes de la septième
conférence internationale sur l'équité
des sexes en sciences et en technologie

du 31 juillet au 5 août 1993

Volume 3
Proceedings of the Seventh
International Gender and Science and
Technology Conference

July 31 – August 5, 1993

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Transformer les sciences et la technologie : notre avenir en dépend

Volume 3
Les Actes de la septième
Conférence internationale sur l'équité
des sexes en sciences et en technlogie

Transforming Science And Technology: Our Future Depends On It

Volume 3
Proceedings of the Seventh
International Gender and Science
and Technology Conference

Editors

Sharon Haggerty
University of Western Ontario
London, Ontario

Ann Holmes
Ontario Women's Directorate
Toronto, Ontario

gasat 7

The University of/l'Université de Waterloo
Waterloo Ontario Canada

31/07/93 - 05/08/93

Transforming Science and Technology: Our Future Depends on it
Volume 3, Proceedings of the seventh International Gender and Science and Technology Conference
Transformer les sciences et la technologie: notre avenir en dépend
Volume 3, Les actes de la septième conférence internationale sur l'équité des sexes en science et en technologie

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We would also like to thank the following organizations and companies for their support. Également nous voulons remercier les organismes et compagnies suivants pour leur participation financière:

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We warmly thank the staff of the Ontario Women's Directorate for their support and cooperation in the achievement of the conference. Nous remercions chaleureusement les employées de la Direction générale de la condition féminine de l'Ontario pour leur soutien et collaboration au succès de la conférence.

GASAT 7 CORE PLANNING COMMITTEE/COMITÉ PRINCIPAL DE PLANIFICATION

Mary Beam, Chair, Local Arrangements Committee *Ontario Teachers' Federation*
Fédération des enseignantes et enseignants de l'Ontario
Sharon Haggerty, Program Chair *University of Western Ontario*
Ann Holmes, Conference Chair *Ontario Women's Directorate*
la Direction générale de la condition féminine de l'Ontario
Karin Caue, Conference Coordinator

GASAT 7 LOCAL ARRANGEMENTS COMMITTEE/COMITÉ ORGANISATEUR LOCAL

Mary Beam, Chair *Ontario Teachers' Federation*
Fédération des enseignantes et enseignants de l'Ontario
Lynda Gyorffy, *Kitchener/Waterloo University Women's Club*;
Bill Lennox, *University of Waterloo*; Kerry Mahoney, *University of Waterloo*;
Merry Swanson, *Bell Canada*; Beth Weckman, *University of Waterloo*.

GASAT 7 INTERNATIONAL REFERENCE GROUP/GROUPE DE RÉFÉRENCE INTERNATIONAL

Ann Marie Israelsson, *Sweden*
Jayshree Mehta, *India*
Lesley Parker, *Australia*

Shirley Malcom, *USA*
Patricia Murphy, *UK*
Stella Williams, *Nigeria*

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Changing the FACE OF SCIENCE

THE GAZETTE, MONTREAL, MONDAY, AUGUST 2, 1993

Messing's work combines many of her loves – feminism, science and social activism.

Transformation of technology 'a matter of time'

The transformation of science and technology through the participation of women will happen in this generation, says Ontario's minister for women's issues.

"The worldwide transformation will only be a matter of time ... It will be in our lifetimes, not just our children's lifetime," Marion Boyd told delegates at the seventh International Gender and Science and Technology Conference.

Boyd

"Unless women are participating in every walk of life, it's going to be increasingly difficult for us, as a community, to get the kind of creative new ideas that we need in a very technologically advanced world," said Boyd, who is also Ontario's Attorney General.

In an interview, Boyd said educators in areas of study such as physics and engineering, which have traditionally been male-dominated, must think of "new ways of learning" to attract more women.

Make room for women in world of technology

WATERLOO, Ont. (CP) — Science and technology must be taken out of the laboratories and passed on to everyone, especially women, an Indian scientist told a conference this weekend.

"You can't have 50 per cent of the population prevented from understanding the benefits of technology and science and expect to develop as a society," said Jayshree Mehta, a speaker at the seventh International Gender and Science and Technology Conference being held here this week.

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> “I was told off the record that the male biologists' wives wouldn't tolerate their husbands going out in the field with a woman.”
>
> — Sharon Haggerty, at left.

IF YOU GO

☐ **WHAT:** Seventh annual Gender and Science and Technology conference
☐ **WHEN:** July 31-Aug. 5
☐ **WHERE:** University of Waterloo
☐ **WHO:** Guest speaker: Marion Boyd, attorney-general for Ontario and minister responsible for women's issues; other speakers include Jayshree Mehta of India, who will discuss how she established a learning network for rural women and children to teach them about science

SPARKING WOMEN'S INTEREST IN MALE-DOMINATED WORLDS OF MATH AND SCIENCE

By LICIA CORBELLA
Toronto Sun 9 August '93

WATERLOO — The task: To make the best water holder possible out of 20 straws, a length of plastic wrap and three long strips of masking tape.

Within moments, two groups of four women from as far away as Sweden, Australia and Kenya begin discussing the shape their vessel will take.

There is much laughter, and that, explains Karen Hansen, is the key to getting people – particularly girls — interested in science and technology.

Hansen is conducting a workshop at the 7th biennial International Gender and Science and Technology Conference (GASAT 7) which ran for one week until last Thursday at the University of Waterloo.

Open up

Science not just for scientists, UW conference told

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Dissecting deters female scientists, conference is told

6 August '93

By Michael Smith
TORONTO STAR

WATERLOO — Even as simple a thing as having to dissect a frog can be a barrier to girls entering scientific fields, delegates to an international conference on science and technology have been told.

"A surprising number of girls are just put off by having to do mean things to animals," biologist Karen Messing told the final session of the seventh Gender and Science and Technology Conference yesterday.

Summing up the five-day meeting, which drew 230 participants, most of them women, from 25 countries, Messing said attempts to entice more women into scientific and technical fields have largely failed.

"Initially, we thought we could tell young women: 'Come on in, we're having a wonderful time,'" she said. "We are now sadder and wiser.

"If it were easy and automatic for women to be integrated into these professions, they would already be there," said Messing, who is director of a public health institute at the University of Quebec at Montreal.

"For women, putting the technical and scientific information into a human context is really of the first importance," Messing said.

But she added, "It is not enough to make women change, to make women learn the skills.

"All the assertiveness training in the world will not solve the problems of the first woman mechanic in an all-male machine shop."

The eighth International gender and science conference is to be held in India probably in January, 1996, conference organizers said.

Female role in science

A conference dedicated to examining the inclusion of girls and women in the fields of science and technology will be held at the University of Waterloo at the end of this month.

Woman scientists who are members of GASAT, the International Gender and Science and Technology Association, view their mandate as the fostering of gender-inclusive science and technology or, as Canadian scientist and feminist Ursula Franklin puts it, "science as if people mattered."

This international association brings together scientists and educators from Africa, Sweden, India, the U.K., Canada, the U.S. and Australia – 37 countries in all.

"If women want to change the technological order in any significant way," Franklin writes, "it is vital for us to strengthen bonding among ourselves and to understand the structure and the dynamics of technology much better than we do now."

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WELCOMING THE DELEGATES AND OTHER CONFERENCE MOMENTS

On the Saturday evening, the participants in GASAT 7 were welcomed in a variety of ways. First, the conference organizers welcomed them to the event. Then Gaell Hildebrand, Co-convenor of GASAT 6, spoke as the link between this and other GASAT conferences.

Gaell introduced Karen Joseph whose role it was to welcome us to the place. Karen is a member of the Kwakwak'awakw Nation, a First Nation from the west coast of Canada. She first thanked the people whose lands we were on and then asked for guidance and strength for us in our deliberations of the next few days. She sang a song of welcome which belongs to her father, a band chief. She had to have his permission to sing it.

Karen is a fourth year micro-biology student at the University of British Columbia and a contributor to the conference. The image of Karen, wearing her traditional red vest decorated with pearl buttons combined with shorts and sandals, will stay with many of us. She spoke and sang and drummed for us. Her strong words and presence in front of a large gathering of strangers were very moving.

The Consumer Researcher Collaboration Committee, a group of people with disabilities, gave a symposium which is described in these proceedings. During the conference Anne Abbott, a member of the C.R.C.C., was seen using her Blissymbolics board to communicate with other delegates. We learned that a young Ontario woman, Rachel Zimmerman, has invented a computer program which links the computer with a touch-sensitive board allowing the user to communicate independently and the information to be stored.

At the end of the conference, after all the speeches and acknowledgements, Karen Joseph linked with Madeleine MacIvor, Assistant Director of the First Nations House of Learning at the University of British Columbia and Yvonne Leaf from the Akwesasne Reserve near Cornwall, Ontario to close the event in celebratory style.

Some of us had 'learned' the chorus to a Nuu-chah-nulth song which can be sung and danced by anyone. We were told that in First Nations culture it is rude to refuse an invitation to join in. Under 'threat' of having to hold a potlatch we all got up and followed Karen's drumming in the song and dance which wound us around the dining room and sent us off in true GASAT-participatory style.

GASAT 7 CONFERENCE SUMMARY

GASAT 7 was held at the University of Waterloo in Waterloo, Ontario from July 31 to August 5. It was organized by the Ontario Women's Directorate (OWD) and co-sponsored by the OWD and the University of Waterloo. Funding was also received from the Canadian federal government, several Ontario government ministries, and a number of private and public sector organizations. Conference delegates included scientists, educators, employers and other individuals concerned with this issue.

The purpose of GASAT 7 was to explore and discuss the changes required to attract and retain women and girls in the study and practice of science and technology - whether they live in Sweden or India, Africa or Canada.

The inclusion of girls and women in the study and practice of science and technology is not only of benefit to the potential participants -- it also greatly enhances these fields. Women have demonstrated that they can play an active role and bring new perspectives to these fields. With many women opting out of science and technology the economy loses potential talent and science loses their ideas and contributions.

The program of GASAT 7 focused on four major themes:

- recruitment and retention of girls and women in science, engineering and technology;
- developing a feminist perspective on science that recognizes the diversity of experiences of women, girls and indigenous peoples;
- creating a more inviting climate for work and study and developing strategies for change; and
- gender-sensitive science, engineering and technology curricula.

The six previous conferences have been a contributing force in the worldwide advancement of knowledge, understanding and program development on the issue of gender and science and technology. Since 1981, the GASAT Association has held biennial conferences; first in The Netherlands, then in Norway, England, the United States, Israel and Australia.

How it all started

The Ontario Women's Directorate (OWD), with its mandate to work toward economic, legal and social equality for all women in Ontario, recognized the value of hosting an event such as GASAT 7 in Canada. Not only would sharing Canadian experiences and learning from international colleagues be of tremendous value to all participants, but also media coverage would raise public awareness on these important issues. The Minister Responsible for Women's Issues supported the OWD bid presented at GASAT 5, in September, 1989 in Haifa, Israel. The proposal was accepted and planning for the 1993 conference began soon afterward. Information meetings to foster interest and gather community support for the conference were held in Waterloo, Guelph, London and Toronto. In subsequent months, a core committee was formed and the planning began in earnest.

In addition, a local committee was set up in Waterloo to plan community liaison, an inter-ministerial committee was established to involve various Ontario government ministries in the conference development and a Toronto activities committee was organized to plan and host pre-and-post-conference activities for delegates visiting that city.

Key GASAT concept: participation

GASAT 7, in keeping with previous GASAT gatherings, was a highly participatory event. Before any of the participants left their countries of origin, the sharing and learning process began. The *Call for Papers* was distributed world-wide to potential GASAT participants in January, 1992. Proposals for contributions were sent to the GASAT 7 Program Chair, who coordinated a Canada-wide review process. The final papers and other contributions were then prepared by their various authors.

The full papers and outlines of the workshops, panel discussions and round tables were published in two volumes of *Contributions*, which were distributed to GASAT participants in May, 1993. This allowed delegates to become familiar with the diverse and numerous topics to be presented at the conference. Most of the delegates were contributors who prepared either a summary of their paper or organized a workshop, round table or symposium to present their contribution.

All delegates belonged to a home group, another inclusionary concept, which provided delegates with a base from which to explore and synthesize issues raised at the conference. Each group of about 20 people and a facilitator met daily. The groups were organized with as international a makeup as possible so a diverse range of experiences could be shared.

Because of the diversity of Canada's population and our cultural value of inclusion, the OWD connected to the broader community to ensure full participation. This included

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contact with persons with disabilities, aboriginal peoples, racial and ethnocultural minorities, women's groups and employers. Contact was also made with groups in the outlying regions of the country to ensure their participation. As a result, several individuals, community groups and representative of companies made presentations to the conference to share their experiences and to glean knowledge from the national and international participants. First Nations delegates contributed to the conference agenda by conducting workshops and participating in the opening and closing ceremonies. Connections were made among many aboriginal and original peoples delegates in discussion of the conference theme exploring indigenous science. The disabled community assisted GASAT in setting up appropriate arrangements so they could actively participate and present their perspectives.

A great many organizations and individuals -- all of whom understand the importance of the transformation we seek to achieve participated through donating generous support and hard work. The co-sponsors, patrons and other funders combined with the delegates' registration fees to make the conference fiscally viable. Private sector sponsors also contributed to the conference program content. Committee members in Waterloo, Toronto and London worked many hours to accomplish the organizational details and ensure the quality of the program. The Canadian University Women's Club -- Kitchener/Waterloo Chapter made a special contribution to the comfort and welcome of the participants.

What was accomplished

An important conference objective was to raise awareness and increase knowledge of and understanding about the issues of concern to GASAT so that the broader community would be included. This was accomplished in several ways--

A public education component was organized which involved a thorough media relations campaign. An information package and press release were developed and distributed to selected key national, provincial and local media. The conference received significant coverage on television and radio as well as in newspapers across the country with many media representatives in attendance. Pre-conference press coverage occurred locally and in the home towns of some of the key delegates.

The participants themselves were givers and bearers of increased knowledge and understanding. Firstly, the conference provided an invaluable opportunity for networking and learning firsthand of the experiences of others. Secondly, the knowledge gained from the conference will be passed on to others in the participants' respective workplaces. Summaries of the various presentations and discussions are printed in these conference *Proceedings*.

Here are some comments from the delegates:

"The conference generated a feeling of active participation in vital issues and provided an environment for sharing diverse opinions, ideas and concerns. Congratulations to the organizers for generating such a positive and exciting experience!"

"I am proud that I am associated with GASAT, especially as I come from a part of the world where we lack funds for many projects and I am looking for support for organizations such as GASAT."

"I feel lucky to be a student at GASAT. I now have many wonderful, open, accepting, loving, caring, interested role models."

"Your practice echoed your policy: This is the first time I have experienced such a dynamic and truly feminist conference."

"I learned a lot about gender and science which helped put my own experience as a female engineer into context. It validated my own private feelings and made me aware of the fact that many of my frustrations are not due to a lack of ability on my part, but rather a lack of consideration of others of my needs and understanding as a woman. I could never understand why I 'just didn't get it'. Now I know...and I will work to eliminate such barriers for younger women in engineering universities."

"I enjoyed the conference immensely. I appreciated the assistance and support I received from the GASAT 7 staff and volunteers which allowed me to participate fully in the conference activities. I was especially pleased with GASAT 7's commitment to access for persons with disabilities. I believe that GASAT 7 is an excellent role model for other conference organizers in Canada."

"I lift up my arms to you and I honour you for being the forerunners in creating an equal society in science and technology not only for women but for indigenous people. And I beg of you that you keep doing what you are doing so that maybe some change can come out of all of this - *Gilakas'la*."

"The best conference I ever attended -- a big thank you to all of you wonderful Canadian people!"

The Call to Action

A comprehensive *Call to Action*, which presented steps that must be taken to move this issue forward, was presented at the final plenary session. This Call summarized the perspectives, initiatives and ideas which are at the forefront of world-wide activity in the area of gender and science and technology and which formed the contributions and deliberations of GASAT 7.

This *Call to Action*, delivered by Dr Karen Messing and prepared with input from the experiences of all delegates, recommended that more and better strategies are needed for women to be integrated into scientific and technological professions.

"The conference has been a place to reaffirm some sad truths. Although women are advancing, with the help of an enormous variety of programs and initiatives, progress has not been in proportion to the effort that has been expended and the personal costs to the women at this conference, who have suffered insults, embarrassment and financial loss in their struggles for survival in science/technology professions and in their efforts to hire and retain women scientific and technical personnel."

-- GASAT 7 *Call to Action*, August 5, 1993

GASAT 7 OUTCOMES AND RESOURCES

The GASAT 7 conference played a significant role in educating and enlightening many audiences: the international delegates, their respective workplaces, the numerous individuals involved in organizing and sponsoring the conference and the general Canadian public.

The following resources are available in Canada through inter-library loan or directly from:

Ontario Ministry of Citizenship Resource Centre
77 Bloor Street West, 9th Floor
Toronto, Ontario, Canada M7A 2R9

Phone: 1 (416) 314-7662 Faxcom: 1 (416) 314-6543

Those outside Canada should contact:

Ann Holmes, Chair GASAT 7
Ontario Women's Directorate
2 Carlton Street, 12th Floor
Toronto, Ontario CANADA M5B 2M9

Phone: 1 (416) 314-0351 Faxcom: 1 (416) 314-0256

PUBLIC EDUCATION

- Full text of the conference report
  GASAT 7 media information kit
  Tapes of media coverage and copies of print coverage
  Tapes of the Feminist Forum and International Panel discussions
  Tapes of the opening talk, *Electric Shocks and Culture Shocks*, and the *Call to Action*

BENEFITS TO PARTICIPANTS

- *Call for Papers*
  Conference program
  Networking forms of participants (two packages)

COMMUNICATIONS MATERIALS

- Two volumes of *Contributions*, May 1993
  Data base of participants' contact information

COMMUNITY INVOLVEMENT

- List of contacts for Canadian outreach
  Lists of contributing volunteer organizations

FINANCIAL INFORMATION

- Conference budget for the GASAT Association and the Ontario Women's Directorate
  Background information package for fund-raising

GASAT 8

- Proposal for GASAT 8 in Ahmedabad, India

Information about joining the GASAT Association can be obtained from:

Alison Baignée, GASAT Executive Secretary
Canadian Council of Professional Engineers
401 - 116 Albert Street
Ottawa, Ontario CANADA K1P 5G3

Phone: 1 (613) 232-2474 Faxcom: 1 (613) 230-5759

GASAT 7 RÉSUMÉ DE LA CONFÉRENCE

GASAT 7 a eu lieu à l'Université de Waterloo, à Waterloo (Ontario), du 31 juillet au 5 août. Elle a été organisée par la Direction générale de la condition féminine de l'Ontario (DGCFO) et co-parrainée par la DGCFO et l'Université de Waterloo. Des fonds ont également été octroyés par le gouvernement fédéral canadien, plusieurs ministères du gouvernement ontarien et quelques organismes des secteurs privé et public. Parmi les déléguées et délégués à la conférence, nous avons retrouvé des travailleuses et travaillleurs scientifiques, éducatrices et éducateurs, employeuses et employeurs, et autres personnes intéressées par le sujet.

La conférence GASAT 7 avait pour but d'étudier et de discuter des changements nécessaires pour attirer et retenir les femmes et les jeunes filles dans les milieux d'étude et de pratique des sciences et de la technologie - qu'elles vivent en Suède ou en Inde, en Afrique ou au Canada.

L'intégration des jeunes filles et des femmes dans l'étude et la pratique des sciences et de la technologie, en plus de profiter aux participantes éventuelles, contribue aussi à rehausser l'image de ces domaines. Les femmes ont démontré qu'èlles étaient capables de jouer un rôle actif et d'ajouter une optique nouvelle dans ces domains. Avec un grand nombre de femmes qui quittent les sciences et la technologie, l'économie perd des talents potentiels et la science, des idées et des contributions.

Le programme de la GASAT 7 a porté sur quatre thèmes principaux :

- le recrutement et la rétention des jeunes filles et des femmes dans les domaines des sciences, du génie et de la technologie;
- le développement d'une optique féministe en sciences, qui reconnaisse la diversité des expériences des femmes, des jeunes filles et des autochtones;
- la création d'un milieu d'étude et de travail plus accueillant et l'élaboration de stratégies en vue d'effectuer des changements; et
- l'élaboration de programmes d'études en sciences, en génie et en technologie qui tiennent compte des besoins des femmes.

Les six conférences précédentes ont joué un rôle important dans le monde entier en favorisant le développement des connaissances et l'élaboration de programmes dans le domaine de l'équité des sexes en sciences et en technologie. L'association

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GASAT tient des conférences biennales depuis 1981; tout d'abord aux Pays-Bas, puis en Norvège, en Angleterre, aux États-Unis, en Israël et en Australie.

Raison d'être

La Direction générale de la condition féminine de l'Ontario (DGCFO), qui a pour but de faire avancer la cause de toutes les femmes en Ontario dans les domaines économique, juridique et social, a reconnu l'importance de tenir une conférence comme la GASAT 7 au Canada. Non seulement le partage d'expériences canadiennes et des connaissances de collègues du monde entier serait-il extrêmement bénéfique à toutes les participantes, et participants, mais la couverture des médias permettrait de sensibiliser le public à ces questions importantes. La ministre déléguée à la Condition féminine a appuyé la demande de la DGCFO, présentée à l'occasion de la GASAT 5, en septembre 1989, à Haifa, en Israel. On a entrepris la planification de la conférence de 1993 peu après l'approbation de la demande. Des réunions d'information visant à éveiller l'intérêt et à encourager le soutien communautaire ont été tenues à Waterloo, Guelph, London et Toronto. Dans les mois qui suivirent, on a mis sur pied un comité central et entrepris la planification officielle.

De plus, un comité local a été créé à Waterloo pour organiser la liaison communautaire, un comité interministériel a été établi pour encourager divers ministères du gouvernement ontarien à prendre part à la mise sur pied de la conférence et un comité des activités a été créé à Toronto pour organiser des activités pré- et post-conférence à l'intention des déléguées en visite dans cette ville.

Le facteur décisif de la GASAT : la participation

La GASAT 7, à l'instar des conférences précédentes, était une conférence de participation active. Le processus de partage et d'apprentissage a démarré bien avant que les participantes et participants ne quittent leur pays d'origine pour se rendre au Canada. En janvier 1992, on entreprenait la distribution, dans le monde entier, d'une *Invitation à soumettre des rapports de recherches* à toutes les participantes éventuelles de la GASAT. Des propositions de soumission ont été envoyées à la présidente du programme de la GASAT 7, qui a coordonné un processus d'examen à travers le pays. Les documents finaux et autres soumissions ont ensuite été préparés par les diverses auteures.

Les documents complets et grandes lignes des ateliers, discussions en groupe et tables rondes ont été publiés dans deux volumes de *Soumissions*, distribués aux participantes de la GASAT en mai 1993. Ces documents ont permis aux déléguées de se familiariser avec les diverses et nombreuses questions qui seraient soulevées pendant la conférence. La plupart des déléguées ont contribué, soit en préparant un résumé de leur soumission ou en organisant un atelier, une table ronde ou un symposium pour présenter leur soumission.

Les déléguées ont formé des groupes locaux (un autre concept d'intégration), dans le cadre desquels elles ont pu étudier et analyser les questions qui seraient soulevées pendant la conférence. Chaque groupe, comptant environ 20 membres et une animatrice, s'est rencontré quotidiennement. Les groupes étaient aussi variés que possible, de façon à représenter une vaste gamme d'expériences internationales diverses.

En raison de la diversité de la population canadienne et notre importance culturelle de l'intégration, la DGCFO s'est adressée au public en général pour assurer une participation maximale. Elle a pris contact avec des groupes de personnes qui présentent un handicap, des autochtones, des minorités raciales et ethnoculturelles, des groupes de femmes et des employeuses et employeurs. Cet effort a porté fruits. Plusieurs personnes, groupes communautaires et représentantes et représentants d'entreprises diverses ont assisté à la conférence pour partager leurs expériences et glaner des connaissances d'autres participantes du pays et du monde entier. Des déléguées des Premières nations ont contribué à l'ordre du jour de la conférence en conduisant des ateliers et en participant aux cérémonies d'ouverture et de clôture. Un grand nombre de personnes, autochtones et autres, ont noué des liens dans le cadre des discussions de la conférence sur les sciences autochtones. Les groupes de personnes handicapées ont aidé le personnel de la GASAT à prendre les mesures nécessaires pour leur permettre de participer activement et de présenter leurs points de vue.

Un grand nombre d'organismes et de particuliers - comprenant tous l'importance des changements visés - ont contribué à la conférence en offrant soutien et temps. Les organismes de parrainage, fournisseurs de fonds et autres organismes de financement ont ajouté leurs fonds aux frais d'inscription des déléguées pour rendre la conférence viable financièrement. Des organismes du secteur privé ont également contribué au contenu du programme de la conférence. Les membres du comité, à Waterloo, Toronto et London, ont consacré de nombreuses heures pour mettre au point les détails organisationnels et assurer la qualité du programme. Le Canadian University Women's Club -- chapitre de Kitchener/Waterloo -- s'est chargé de l'accueil et du confort des participantes et participants.

Ce qui a été accompli

Un des principaux objectifs de la conférence était de sensibiliser et d'améliorer les connaissances et la compréhension relatives aux questions examinées par la GASAT, de façon à ce que le public en général soit inclus. Ceci a été accompli de diverses façons.

L'éducation du public a été réalisée par le biais d'une campagne exhaustive de relation avec les médias. Une trousse d'information et un communiqué de presse ont été préparés et distribués aux principaux médias nationaux, provinciaux et locaux. La conférence a bénéficié d'une couverture importante à la télévision et à la radio, ainsi que dans les journaux de tout le pays, et un grand nombre de représentantes et représentants des médias ont assisté à la conférence. La presse a annoncé la conférence localement et dans les villes de certaines des déléguées clés.

Les participantes et participants ont autant reçu que donné pendant cette conférence. Tout d'abord, la conférence leur a fourni la possibilité extraordinaire de former des réseaux et d'apprendre de première main des expériences d'autres personnes. Et deuxièmement, les connaissances acquises dans le cadre de cette conférence pourront être transmises à d'autres personnes dans les milieux de travail respectifs des participantes et participants. Des résumés des diverses présentations et discussions figurent dans ces *Actes* de la conférence.

Voici quelques commentaires des déléguées :

«La conférence nous a vraiment donné l'impression de prendre une part active à des questions essentielles et nous a permis de partager nos divers points de vue, idées et préoccupations. Félicitations aux organisatrices, cette conférence fut une expérience extrêmement positive et fort intéressante!»

«Je suis fière de participer aux activités de la GASAT, d'autant plus que je viens d'une région du monde où les fonds manquent souvent pour de nombreux projets et où l'on recherche constamment le soutien d'organismes tels que la GASAT.»

«Je me considère chanceuse d'être une étudiante et de pouvoir participer à GASAT. J'ai désormais de nombreux et merveilleux modèles-à-imiter, des personnes ouvertes, ouvertes, aimables, bonnes, attentionnées et intéressantes.»

«J'ai beaucoup appris sur l'équité des sexes dans les sciences, ce qui m'a permis de mieux comprendre ma propre situation en tant qu'ingénieure. Cette conférence a confirmé mes impressions secrètes et m'a permis de comprendre qu'un grand nombre de mes frustrations ne viennent pas d'un manque de compétences de ma part, mais plutôt d'un manque de respect à l'égard de mes besoins de femme. Je me suis toujours demandée pourquoi je «n'y arrivais pas». Maintenant, je le sais... et je vais m'efforcer de contribuer à l'élimination de ces obstacles pour les jeunes filles dans les universités du génie.»

«J'ai beaucoup aimé la conférence. J'ai apprécié l'aide et le soutien du personnel et des bénévoles de la GASAT 7, qui m'ont permis de participer pleinement aux activités de la conférence. J'ai particulièrement apprécié l'effort des gens de la GASAT 7 à rendre cette conférence accessible aux personnes qui présentent un handicap. J'estime que la GASAT 7 est un excellent modèle-à-imiter pour d'autres organisatrices et organisateurs de conférences au Canada.»

«Je tiens à vous féliciter de tracer le chemin de l'égalité sociale dans les domaines des sciences et de la technologie, non seulement pour les femmes, mais aussi pour les peuples autochtones. Et je vous supplie de continuer sur cette voie, pour que des changements puissent être apportés. *Gilakas'la.*»

«C'est la meilleure conférence à laquelle j'aie assisté - un grand merci à tous ces gens merveilleux au Canada!»

L'appel à l'action

Un *Appel à l'action* complet, qui décrit les mesures à prendre pour aller de l'avant, a été présenté la dernière séance plénière. Cet appel à l'action récapitulait les points de vue, initiatives et idées au premier plan de l'activité mondiale en matière d'équité des sexes en sciences et en technologie et à la base des soumissions et délibérations de la GASAT 7. Dans cet *Appel à l'action*, presenté par Dr. Karen Messing, tient compte des expériences de toutes les déléguées, nous recommandons qu'un plus grand nombre de stratégies, toujours meilleures, soient élaborées à l'intention des femmes dans les professions scientifiques et techniques.

«Cette conférence nous a permis de confirmer certaines vérités fort tristes. Bien que les femmes aient beaucoup avancé dans ce domaine, grâce aux nombreux programmes et initiatives mis sur pied, les progrès accomplis ne correspondent pas à l'effort qui a été déployé et à ce qu'ont dû subir les femmes qui ont participé à cette conférence en insultes, embarras et pertes financières, dans leur lutte pour survivre dans les professions scientifiques et techniques et dans leurs efforts visant à embaucher et à retenir des femmes dans leur personnel scientifique et technique.»

-- *Appel à l'action*, GASAT 7, 5 août 1993

RÉSULTATS ET RESSOURCES DE LA GASAT 7

La conférence GASAT 7 a joué un rôle important dans l'éducation et la prise de conscience de nombreuses personnes : les déléguées internationales, leurs milieux de travail respectifs, les nombreuses personnes qui ont participé à l'organisation et aux activités de parrainage de la conférence et l'ensemble des Canadiennes et Canadiens.

Les ressources suivantes sont disponibles au Canada par le biais de prêts entre bibliothèques ou directement, auprès de :

Centre de documentation du ministère des Affaires civiques de l'Ontario
77, rue Bloor ouest, 9ᵉ étage
Toronto (Ontario) Canada M7A 2R9

Tél. : 1 (416) 314-7662 Télécopieur : 1 (416) 314-6543

Pour ceux et celles à l'extérieur du Canada, veuillez communiquer avec:

Ann Holmes
Direction générale de la condition féminine de l'"Ontario
2, rue Carlton, 12eme étage
Toronto (Ontario) Canada M5B 2M9

Tél.: 1 (416) 314-0351 Télécopieur: 1 (416) 314-0256

ÉDUCATION DU PUBLIC

- Texte complet du rapport de la conférence
  Cahier de presse de la GASAT 7
  Cassettes de la couverture des médias et copies des articles parus dans les journaux
  Cassettes des discussions du forum féministe et du panel international
  Cassettes et textes du discours d'ouverture, *Chocs électriques et chocs culturels* et l'*Appel à l'action*

POUR LES PARTICIPANTES

- *Invitation à soumettre des rapports de recherches*
  Programme de la conférence
  Réseautage des participantes (deux trousses)

DOCUMENTS DE COMMUNICATIONS

- Deux volumes de *Soumissions*, mai 1993
  Base de données avec renseignements sur les participantes

PARTICIPATION COMMUNAUTAIRE

- Liste de personnes à contacter pour l'intervention communautaire au Canada
  Listes des organismes qui ont contribué au bénévolat

RENSEIGNEMENTS FINANCIERS

- Budget pour la conférence de l'association GASAT et de la Direction générale de la condition féminine de l'Ontario
  Trousse d'information pour les levées de fonds

GASAT 8

- Proposition de tenir la GASAT 8 à Ahmedabad, en Inde

Pour obtenir des renseignments sur comment devenir membre de GASAT, veuillez communiquer avec:

Alison Baignée
GASAT Executive Secretary
a/s Conseil Canadien des ingénieurs
401 - 116 rue Albert
Ottawa (Ontario) Canada K1P 5G3

Tél: 1 (613) 232-2474 Télécopieur: 1 (613) 230-5759

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EXCERPTS FROM REMARKS by THE HONOURABLE MARION BOYD ONTARIO MINISTER RESPONSIBLE FOR WOMEN'S ISSUES

WELCOME ADDRESS

AUGUST 1, 1993

I'm happy to be here to "officially" welcome you -- to Canada, to Ontario, and to the Seventh International Gender and Science and Technology Conference. This is the first GASAT conference to be held in this country, and we are proud to be your hosts.

I know that some of you have travelled long distances to attend this event -- some from as far away as Nigeria, India and Australia. I know that others have travelled long distances without crossing a single national border. In a country as large as Canada, even a visit to a sister province -- like British Columbia or Newfoundland -- can feel like international travel. So I welcome all of you -- my fellow Canadians, and our sisters and brothers from other nations -- to this country, to this province, and to this event which brings us all here.

As a woman, as a mother, and Minister Responsible for Women's Issues, I have a strong personal interest in matters of equity for women -- equity in employment, equity in matters of justice, equity in education. This interest in equity is one which is shared by the government of the province which I represent. We are truly honoured to be your hosts, and to welcome GASAT to Canada.

Each one of you is here because of your deep commitment to ending the gender bias which exists in science and technology -- from the way these disciplines are taught in the schools to the way they are applied in industry. The submissions which you have prepared are extremely impressive, and represent a wealth of knowledge, experience and insight. I assure you, that we here in Ontario will use that information to continue to transform science and technology in our own province. I am certain that the discussions you have here over the next four days, and the network of colleagues that you'll meet, will serve you well when you return to your home countries or provinces to carry on the "transformation" process there.

As I look around this room, I am pleased to see the diversity of people who will lend their insight to this process. I am especially proud that the organizers have made a special effort to facilitate the participation of people with disabilities, and to subsidize a large number of delegates from technologically developing countries.

You have my very best wishes for an enriching and inspiring conference. I hope that the next four days surpass your expectations. With such an accomplished group of individuals working together toward a common goal, the world-wide transformation of science and technology can be only a matter of time.

VISITORS' AND SPONSORS' DAY ADDRESS

AUGUST 4, 1993

As the last full day of this seventh GASAT Conference nears an end, I would like to say a few words of thanks to those who have helped make this event such a success.

As Minister Responsible for Women's Issues, and on behalf of the Government of Ontario, I would like to express how proud and pleased we are to have been able to host this gathering. It seems to me that the theme of this conference, "Transforming Science and Technology," sets out exactly what it is the Gender and Science and Technology Association is trying to do. And that is: to open doors, to remove barriers which have excluded girls and women from the sciences -- in short, to *transform* the male-dominated arena of science and technology into something new and inclusive of women. This transformation will begin with the way that scientific principles are first explained in the classroom -- and will mean dropping the obligatory sports analogies and finding alternatives that are relevant to young girls' interests and experiences. And it will extend to the way that we conduct medical research -- where male subjects are considered to be the norm and women are considered as an afterthought -- if they are considered at all.

As the delegates to this conference understand only too well, it is not enough to focus on education and on encouraging girls and young women to continue their math and science studies. It is not enough to train women for jobs in science-related fields. Because if women arrive at the workplace and receive a chilly reception that says, " you are not welcome here," -- if they do not see themselves as women reflected in the content of the work that they do -- then all the education and the training will have been for nothing. Those women will leave, and they will spread the message that "women need not apply". As we transform the educational system, so must we transform the workplaces. Clearly, this is no small undertaking.

GASAT's efforts to *transform* science and technology are being matched by similar efforts to transform other fields of endeavour by community organizations, governments, and professional associations the world over. These are all part of a much larger effort to *transform our world* into a place that holds greater opportunities for girls and women -- of all races, and of all nationalities. And we *are* moving closer to this goal.

This conference was made possible through the generous support and hard work of a great many organizations and individuals -- all of whom understand the importance of the transformation we seek to achieve.

First of all, I'ld like to thank our sponsors: the University of Waterloo -- for opening your doors to us and offering the use of your grounds and facilities; and the Ontario Women's Directorate, the agency of the provincial government -- which has generously provided significant staff time and other resources to GASAT 7. Ann Holmes, the Conference Chair, and her colleagues deserve special mention for their tireless efforts.

I would like to thank our patrons: the Social Sciences and Humanities Research Council of Canada; the Ontario Ministry of Education and Training; the Ontario Ministry of Economic Development and Trade; and the Canadian Commission for UNESCO with the Canadian International Development Agency, or CIDA.

We appreciate the assistance of: The Secretary of State's Women's Program and Promotion of Official Languages Program; the Federation of Women Teachers' Associations of Ontario; Warner Lambert; Unilever; McNeil Consumer Products Company; Bell; and Canadian National.

A small, dedicated corps of volunteers worked diligently, and beyond the call of duty to make this conference a reality. I would especially like to thank: Sharon Haggerty, of the University of Western Ontario; Mary Beam, of the Ontario Teachers' Federation; and the team of volunteers from the Kitchener-Waterloo Chapter of the Canadian Federation of University Women, headed by Lynda Gyorffy, who welcomed you so warmly to Waterloo County.

We are all indebted to you for your contributions.

I am proud to be speaking on behalf of a province that has made the achievement of equality for women a top priority. Ontario has been a leader in the industrialized world when it comes to trying to correct the disparity between women's and men's wages. Our Pay Equity Legislation has been recognized as a pioneering step toward the achievement of that goal. We are determined to enact the employment equity legislation we introduced this year -- legislation which seeks to increase employment opportunities for women, members of racial minorities, people with disabilities and Aboriginal people. The government agency which I oversee -- the Ontario Women's Directorate -- works both inside and outside government, to foster women's social, legal and economic equality. As well, the Directorate works particularly hard to eliminate violence against women, the ugliest barrier to women's equality.

Over the past several years, our provincial -- and national -- economy has been undergoing fundamental, structural changes. We are moving from an industry-based economy to an economy based on technology and information. As these structural changes continue, employers are coming to realize that it is in their best interest to train, hire and promote women, and to encourage women to pursue "non-traditional" careers. Companies are beginning to see that the only way that we as a province and a nation will prosper in the next century is to make the best use of all the human talent available to us. We cannot afford to waste the contribution of a single person. This means hiring women -- women of all racial and ethnic backgrounds, aboriginal women, able-bodied women and women with disabilities.

As most of us here realize, though, economic necessity is not the only argument for transforming science and technology. Economic gains are one important by-product. An equally important reason that we need to transform science and technology is that the way that they have traditionally been taught and applied is biased against women. It is simply *not fair* -- this arbitrary exclusion of over half the world's brainpower and half the world's creativity. When we hold up our practice of science and technology against the yardstick of social justice, the sciences come up short.

It is truly inspiring to see so many committed individuals determined to help girls and young women believe that they can accomplish whatever they dream of accomplishing -- and working to give them the education and the skills to do that.

Not only does our future depend on it, it's the right and just thing to do.

• • •

After her remarks, the Minister was warmly thanked by Jan Harding, Chair of the GASAT Association Board, and presented with a GASAT 7 Conference mug.

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EXTRAITS DES COMMENTAIRES DE L'HONORABLE MARION BOYD MINISTRE DÉLÉGUÉE A LA CONDITION FÉMININE DE L'ONTARIO

ALLOCUTION DE BIENVENUE, LE 1er AOÛT 1993

Je suis heureuse de vous souhaiter la bienvenue au Canada, en Ontario, et à la septième conférence GASAT (Gender and Science and Technology). C'est la première fois que cette conférence a lieu dans ce pays et nous sommes fiers de vous accueillir. Je sais que certaines personnes sont venues de très loin pour participer à cette conférence -- notamment du Nigeria, de l'Inde et de l'Australie. Je sais aussi que d'autres participantes et participants ont voyagé sur de longues distances sans jamais traverser une frontière nationale. Dans notre pays si vaste, une visite dans une province différente, comme la Colombie-Britannique ou Terre-Neuve, peut devenir un grand voyage. Je souhaite donc la bienvenue à toutes les Canadiennes et à tous les Canadiens, ainsi qu'à nos soeurs et frères d'autres pays.

En tant que femme, mère et ministre déléguée à la Condition féminine, je porte un intérêt tout personnel à la question de l'équité pour les femmes -- l'équité en matière d'emploi, l'équité en matière de justice et l'équité en matière d'éducation. Et cet intérêt est partagé par le gouvernement de la province que je représente. Nous sommes vraiment très fiers de vous recevoir et d'organiser la conférence GASAT cette année.

Vous assistez à cette conférence parce que vous voulez vraiment éliminer les partis pris contre l'autre sexe qui existent dans le domaine des sciences et de la technologie, qu'il s'agisse de la façon dons ces matières sont enseignées ou de leur application dans l'industrie. Les rapports que vous avez soumis sont très impressionnants et comprennent un trésor de connaissances, d'expérience et d'opinions. Je vous promets que nous nous servirons de cette information pour continuer à transformer les sciences et la technologie dans notre province. Je suis covaincue que les discussions qui se tiendront au cours des quatre prochains jours, et le réseau de communications qui se formera, vous aideront à poursuivre votre processus de «transformation» lorque vous retournerez dans votre province ou pays.

Je constate avec plaisir qu'une diversité de personne participeront à la conférence. Je suis particulièrement fière du fait que les organisatrices ont fait un effort spécial pour favoriser la participation de personnes souffrant d'un handicap et ont subventionné la visite de plusieurs personnes provenant de pays en voie de développement technologique.

J'espére de toute coeur que cette conférence sera enrichissante et que les quatre prochains jours dépasseront vos attentes. En regardant ce groupe d'individus pleins de talents qui travaillent ensemble pour réaliser un but commun, je n'ai aucun doute que la transformation mondiale du domaine des sciences et de la technologie se réalisera bientôt.

ALLOCUTION POUR LA JOURNÉE DES VISITEURS ET DES COMMANDITAIRES

LE 4 AOÛT 1993

A la fin de cette dernière journée complète de la septième conférence GASAT, j'aimerais remercier toutes les personnes qui ont rendu possible cet événement.

En tant que ministre déléguée à la Condition féminine, et au nom du gouvernement de l'Ontario, je voudrais partager avec vous ma joie et ma fierté vis-à-vis cette rencontre. Je crois que le thème de cette conférence «Transformer les sciences et la technologie: notre avenir en dépend» illustre parfaitement l'objectif de l'association GASAT (Gender and Science and Technology). L'association travaille à faire disparaître les obstacles qui empêchent les femmes et les jeunes filles de s'intégrer aux sciences; elle veut *transformer* le domaine des sciences et de la technologie qui était autrefois orienté vers les hommes pour qu'il accueille maintenant les femmes. Cette transformation débutera avec la façon d'expliquer les principes scientifiques en classe; il faudra donc abandonner les comparaisons avec les images sportives pour se servir de notions qui tiennent compte des intérêts et de l'expérience des jeunes filles. Ceci s'étendra également à la façon dont nous réalisons les recherches médicales, c'est-à-dire que des sujets femelles seront choisis aussi souvent que des sujets mâles.

Les participantes et participants à cette conférence savent très bien qu'il n'est pas suffisant d'encourager les filles et les jeunes femmes à poursuivre leurs études en mathématiques et en sciences. Il ne s'agit pas non plus de se concentrer sur la formation des femmes dans les domaines scientifiques. Il arrive trop souvent que les femmes doivent affronter une attitute peu chaleureuse dans leur milieu de travail. Si ces femmes ne réalisent pas la valeur de leur contribution au travail, leur éducation et leur formation ne servent à rien. Elles communiqueront à leurs consoeurs l'idée que ce domaine n'est pas pour elles. En transformant le systéme d'éducation, nous devons également transformer le milieu de travail. Il ne s'agit pas d'um projet de tout repos.

Les efforts de GASAT visant à *transformer* les sciences et la technologie se porsuivent parallèlement à des efforts internationaux dans d'autres domaines qui sont entrepris par des groupes communautaires, des gouvernements et des associations professionnelles. Tous ces programmes visent à *transformer notre monde* pour qu'il offre de plus grandes possibilités aux filles et aux femmes de toute race et de toute nationalité. Et nous nous raprochons de ce but!

Cette conférence a été rendue possible grâce à l'appui et aux efforts de plusieurs organismes et particuliers qui comprennent l'importance de cette transformation.

J'aimerais remercier nos promoteurs: l'université de Waterloo qui nous a ouvert ses portes et nous a permis d'utiliser ses installations, et la Direction générale de la condition féminine de l'Ontario, un organisme du gouvernement provincial, qui a consacré un bon nombre de ses ressources humaines à l'organisation de la conférence GASAT 7 et a offert les services de M^me^ Ann Holmes, présidente de la conférence, et de ses collègues.

J'aimerais également remercier le Conseil de recherches en sciences humaines du Canada, le ministére de l'Éducation et de la Formation de l'Ontario, le ministère du Développement économique et du Commerce de l'Ontario, et la Commission canadienne pour l'UNESCO en collaboration avec l'ACDI (Agence canadienne de développement international).

Je voudrais aussi souligner l'appui du Programme de promotion de la femme et Programme de promotion des langues officielles du Secrétariat d'État, la Fédération des associations des enseignantes de l'Ontario, Warner Lambert, Unilever, l'entreprise McNeil Consumer Products, Bell et le Canadien National.

Il ne faut pas oublier le travail acharné d'un petit groupe bénévoles qui ont oeuvré pendant des mois pour mettre sur pied cette conférence – et spécialement Dr. Sharon Haggerty de l'université Western Ontario, M^{me} Mary Beam de la Fédération des enseignantes et des enseignants de l'Ontario, et une équipe dévouée de bénévoles de la section de Kitchener-Waterloo de la Fédération canadienne des femmes diplômées des universités, sous la direction de M^{me} Lynda Gyorffy, qui vous ont acceuillis si chaleureusement dans le comté de Waterloo.

Leurs efforts ne passent certainement pas inaperçus.

Je suis fière de représenter une province qui oeuvre sans relâche pour assurer l'égalité des femmes. L'Ontario est un des chefs de file du monde industrialisé en matière de rectification de la disparité salariale entre les femmes et les hommes.

Nos lois sur l'équité salariale sont des plus innovatrices dans le domaine. Nous nous sommes engagés à adopter les lois sur l'équité salariale qui ont été présentérs cette année. Ces lois visent à offrir de plus grandes possibilités d'emploi aux femmes, aux membres de minorités raciales, aux personnes handicapées et aux Autochtones. L'organisme gouvernemental que je représente -- la Direction géneralé de la condition féminine de l'Ontario -- oeuvre à l'intérieur et à l'extérieur du gouvernement pour promouvoir l'égalité sociale, juridique et économique des femmes. De plus, la Direction porte une attention particuliére à l'élimination de la violence faite aux femmes, qui est le pire obstacle à l'égalité des femmes.

Au cours des dernières années, notre économie provinciale -- et nationale -- a fait l'objet de modifications structurelles fondamentales. Nous passons d'une économie industrielle à une économie fondée sur la technologie et l'information. Ces modifications structurelles se poursuivent et les employeurs se rendent compte qu'ils gagneront à former, à promouvoir des femmes, ainsi qu'à encourager celles-ci à solliciter des postes «non traditionnels». Les entreprises s'aperçoivent qu'elles doivent utiliser au mieux les ressources humaines disponibles si elles veulent une province et une nation prospères au siècle prochain. Il ne faut plus gaspiller la contribution de tout particulier. Il faut donc embaucher des femmes de races et de cultures diverses, des femmes autochtones, des femmes handicapées et toute autre femme compétente.

Comme la plupart d'entre nous le savent déja, les avantages économiques ne sont pas la seule raison de transformer le domaine des sciences et de la technologie. Une autre raison tout aussi importante est que la façon dont les sciences et la technologie ont été enseignées et utilisées par le passé était au détriment des femmes. Ceci est tout simplement **injuste** -- il s'agit de l'exclusion de cinquante pour cent de la matière grise et de la créativité du monde. Lorsque l'on mesure le domaine des sciences et de la technologie en terms de justice sociale, on réalise que des problèmes sérieux existent.

Il est vraiment impressionnant de voir un si grand nombre de personnes dévouées à aider les filles et les jeunes femmes à réaliser leurs rêves -- et oeuvrant pour leur fournir l'education et les compétences dont elles ont besoin pour ce faire.

Il ne s'agit pas seulement de viser un avenir meilleur, il s'agit d'être juste et équitable!

* * *

Après les commentaires de la ministre, Jan Harding l'a remerciée chaleureusement. Dr. Harding, présidente du conseil d'administration GASAT, a donné à la ministre une tasse GASAT 7.

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ELECTRIC SHOCKS AND CULTURE SHOCKS: RISKS FOR WOMEN ENTERING SCIENCE AND TECHNOLOGY

Karen Messing
Centre pour l'étude des interactions biologiques entre la santé et l'environnement
Université du Québec à Montréal

INTRODUCTION

A woman described to us her first job, as an electrician in a multinational corporation. She started five years ago as the only woman among 80 electricians in the plant (she still is). She was assigned to a partner, a man who did not like the idea of working with a woman. He made her life unpleasant in various ways, from refusing to explain how things worked to making nasty comments on her appearance. She loved the work anyway, and did not want to complain, so she put up with it without comment. One day he went further in his attempt to get rid of her, and rewired a circuit she was supposed to work with. If she had not discovered what he had done before working on it, she would have received a tremendous shock which could have threatened her health. She then requested and was granted a change of partner; the man is still working for the company.

That is one side of the story. The other side is this woman's total satisfaction with her job. She is a single parent of three children, and she is proud that she earns enough to support them much better than most women with her responsibilities. During her third pregnancy, she refused to take the full leave for which she would have been eligible, because she says she would have been bored staying at home. She worked right up to the day of giving birth.[1]

So these are the issues we often confront. On the negative side, we have the very powerful emotions and radical actions excited by women's attempts to enter an unaccustomed role. On the positive side, the great financial and personal benefits which accrue to women who succeed in entering.

These stakes are high, and in the current hard times they are becoming critical. And the defense of bastions of power is not confined to blue-collar workers. I am sure that every woman in this room has had the experience of finding out with a terrible shock what disproportionately heavy weapons are unleashed by the tiniest challenge to power. We ourselves, the first time we mentioned sexism in a departmental meeting in 1978, ended the meeting barricaded in our office with the male professors pounding on our door and yelling. In our science faculty with 83% men, women experience the same hostility as in blue-collar jobs, but instead of hearing obscenities and being attacked with electric shocks, we may hear about excellence, quality, rigour and standards. These words are very seductive, chills run up and down my spine as I yearn to be excellent and rigourous. But these words are used to argue against hiring women, against allowing space and time for scientists' family responsibilities, against gender-inclusive research and against including in curricula subjects interesting to women. And the emotion involved is of the same intensity as we heard about in the factory.

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[1] Emond, Carole, Louise Thiffault. 1992. Etude d'un poste de travail non-traditionnel. Paper submitted for the course BIO 1550, Université du Québec à Montréal.

So, as I talk about some of the issues which arise as women enter and transform scientific and technical fields, I don't want anyone to lose sight of the fact that we are talking about power - economic and social power. And change gives power to new groups and takes power from others, who quite understandably fight back any way they can.

The violence we experience can be explicit, like electric shocks, or it can be subtle, as when qualified women are ignored and treated as non-existent.[2] And it can be invisible: without anyone noticing, whole fields of study have developed in relation to the bodies, life patterns and interests of one sex, considered the norm, while women's bodies, life patterns and interests are considered, if at all, as peripheral, a special case. Rules are then drawn up to define these practices as quality, excellence and rigour. The consequences of these practices can be severe: exclusion of women and women's issues, loss of information, delay in solving problems, and human suffering. I will give examples of the effects of androcentric science drawn from my own field of occupational health. I will show how power issues in occupational health disguise themselves as questions of pure scientific practice.

POWER ISSUES AND ANDROCENTRIC STUDY OF OCCUPATIONAL HEALTH

The labour market is segregated by sex. And even though the same job has often been assigned to women in one time and place and to men a few years later or a few miles away, a sexual division of jobs has existed for hundreds of years.[3] It has been calculated that for the sexes to be evenly distributed across job titles in North America, two-thirds of both men and women would have to change jobs.[4] Women work primarily in the service sector, whereas men are assigned to a variety of agricultural, mining, production, construction and service jobs. Also, women are more apt to work in small workplaces employing less than 50 workers.

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[2] Tancred, Peta and Susan Czarnocki. 1993. The revolving door: women's exit from non-traditional work. In Martens, Debra (ed.) Weaving Alliances. Ottawa: Canadian Women's Studies Association.

[3] Bradley, Harriet. 1989. Men's Work, Women's Work. Minneapolis: University of Minnesota Press.

[4] David, Hélène. 1986. Femmes et emploi: le défi de l'égalité. Montréal: Presses de l'Université du Québec.

So women's jobs are different from men's. Historically, occupational health intervention and research has concentrated on men's jobs. Men are much more likely to be compensated for occupational illness, and fewer than 10% of workers in Québec's priority sectors for occupational health intervention are women. I suggest that this is not because women have safer jobs, but because occupational health concepts have been derived from examination of men's jobs. I have chosen to give a few examples in detail rather than trying to cover the wide range of possible examples.[5]

The requirement that populations be uniform or, women keep out

Researchers insist that populations examined be "uniform." It is interesting to see which criteria make subpopulations non-uniform. In cancer research, uniformity might be sought by requiring study subjects to share an urban or rural environment, some nutritional habits or medical history. However, women are frequently eliminated by this criterion. For example, in 1988, Block and colleagues published a study of cancer among phosphate-exposed workers in a fertilizer plant.[6] Among 3400 workers, 173 women were eliminated with the comment "because females accounted for only about 5% of the study population, they were not included in these analyses." However, the 38 male workers in the drying and shipping department were not considered too small a population for study: a significant rise in their death rate was noted.

Another example was the study paid for with $2 million in public funds, relating cancers to a huge number of occupational exposures. When asked why his study excluded women, the researcher replied, " It's a cost-benefit analysis; women don't get many occupational cancers." He did not react when it was pointed out to him that his argument was circular, nor that for women taxpayers, the cost-benefit ratio of a study excluding them was infinitely high. The resulting papers, published in peer-reviewed journals, make no attempt to justify the exclusion of women.[7] Many, many other current examples exist of occupational health research done on male-only samples without justification.

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[5] A fuller discussion of these issues will be found in the following publications:

Messing, Karen, Lucie Dumais, Patrizia Romito. (1992) Prostitutes and chimney sweeps both have problems: Toward full integration of the two sexes in the study of occupational health. Social Science and Medicine 36:47-55.

Messing, K. (1991). Occupational Health and Safety Concerns of Canadian Women: A review/Santé et sécurité des travailleuses: un document de base. Ottawa: Labour Canada 110pp.

Dumais, Lucie et Karen Messing. (1991) La science et le corps des femmes. In Mura, R. Un savoir à notre image: Les critiques féministes des disciplines. Adage, Montréal. pp. 107-122.

Messing, Karen 1992. Doing something about it: Priorities in women's occupational health. Gender and Occupational Health Round Table.Health and Welfare Canada. Ottawa. Pp. 155-161.

Messing, K. and Donna Mergler. (in press). The rat couldn't speak, but we can: Inhumanity in occupational health research. In Hubbard, Ruth and Linda Birke Re-inventing Biology. University of Indiana Press.

[6] Block, Gladys, Genevieve Matanoski, Raymond Seltser, Thomas Mitchell. 1988 Cancer morbidity and mortality in phosphate workers. Cancer Research 48:7298-7303. This is only one of many examples.

In fact, there are some well-identified occupational cancers among women. A study of members of the American Chemical Association shows that women members have significantly high rates of ovarian and breast cancer.[8] A Canadian study also revealed that hairdressers are especially likely to get leukemia and ovarian cancer.[9] But information is sadly lacking in this area.

The elimination of women from studies of occupational cancer reinforces 8the notion that women's jobs are safe and that women's concerns about environmental influences on breast cancer (for example) are unfounded. It becomes justifiable to exclude women's jobs from prevention efforts.

Thus, women may be unjustly robbed of access to state funds and to information about their health in the name of "good" scientific practice. We must ask, good for whom?

The requirement for objectivity or, shutting our ears to women's voices

Problems under study are supposed to be documented objectively. What does this mean? Who is considered to be objective? In order to relate working conditions to illness, researchers refer to "experts" as in the following example, taken from the occupational health literature. In a study of 13,568 workers, experts were asked to class certain jobs as exposed or not exposed to dust. Researchers gave the following justification: "Although [an expert exposure estimate] cannot be considered an ideal reference, it is not biased by misclassifications of exposure according to personal factors as it is based only on job titles and industry sectors."[10] This study goes on to correlate reported symptoms of dust exposure (difficulty breathing, asthma.) with experts' ratings. The study also correlated symptoms of dust exposure with the workers' own reports of dust exposure. Not unsurprisingly, the workers' reports were much more highly correlated with symptoms than were the experts'. In fact, for women workers and less-educated workers, the correlation with experts were quite low. Did the researchers conclude that the experts' estimates were incomplete, class-biased, wrongly applied to women's jobs or out of date? Not at all: "Factors modifying the strength of the association between two estimates of exposure [experts' vs. workers'] are potential recall determinants of exposure. This association was significantly stronger in men than in women, suggesting a better perception of exposure by men... " In other words, if self-reported exposure was better related to symptoms than expert-reported exposure, the self-reports of exposures and symptoms were wrong. If educated men were closer to the experts, the men had made fewer errors than the women or the less-educated. But, in fact, there is no reason why an "expert" who has never been in a workplace is better able than a worker to describe dust exposure, using tables relating exposures to job title derived 7 years previously in another country. There is every reason to suppose that experts consistently underestimate both women's exposures and women's health problems.

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[7] Siemiatycki, Jack, Ron Dewar, Ramzan Lakhani, Louise Nadon, Lesley Richardson, Michel Gérin. 1989. Cancer risks associated with 10 organic dusts: Results from a case-control study in Montréal. American Journal of Industrial Medicine 16: 547-567.

[8] Walrath, J., Li, F.P., Hoar, S.K. 1985. Causes of death among female chemists. American Journal of Public Health 75: 883-885.

[9] Spinelli, J.J., Gallagher, R.P., Band, P. R., Threlfall, W. J. 1984. Multiple myeloma leukemia and cancer of the ovary in cosmetologists and hairdressers. American Journal of Industrial Medicine 6:97-102.

[10] Hsairi, Mohammed, Francine Kauffmann, Michel Chavance, Michel and Patrick Brochard. 1992. Personal factors related to the perception of occupational exposure: An application of a job exposure matrix. International Epidemiology Association Journal 21: 972-980.

The field of menstrual problems is another example. Here is an "objective" scientist, publishing his article on air hostesses' menstrual problems in a well-known scientific journal: "In the course of the discussions which form an integral part of the annual medical examination of hostesses it has become evident that some of these girls have become rather anxious because of [articles in the lay press on the effects of flying on air hostesses]. ... Let us consider the assertion that flying, particularly in jets, has a definitely adverse effect on the menstrual function of hostesses. ... When the individual tables [with this author's results] are studied, it can be seen that the greatest deterioration occurred in regularity, followed by dysmenorrhea. The former is not at all surprising [in view of jet lag]; the latter, however, is not a measurable entity but is highly subjective and it is just here that the psychological aspect may be of the greatest importance."[11]

In more recent article on the same subject from the same journal, researchers reported that beginning airline hostesses underwent unfavourable changes in the menstrual cycle 3.5 times as often as favorable changes. They commented, "There is not enough information to explain the pathophysiology of dysmenorrhea. The frequent association of dysmenorrhea with other [sic] neurotic symptoms is indicative of its psychological origin."[12]

In other words, when the scientist can understand the result, it is objective. When he

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[11] Cameron, R. G. 1969. Effect of flying on the menstrual function of air hostesses. Aerospace Medicine September 1969: 1020-23.

[12] Iglesias, RE., Terrés A., Chavarria, A. 1980. Disorders of the menstrual cycle in airline stewardesses. Aviation, Space and Environmental Medicine May 1980. 518-20.

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doesn't, it is subjective. This contempt for women's perceptions has had a very detrimental effect on women's health. Well over half of European and North American women of reproductive age now do paid work, and 30-90% of menstruating women report lower abdominal and lower back pain associated with the menstrual periods.[13,14,15] But Western occupational health literature has almost never included menstrual symptoms among outcome variables. A 1975-91 search of the Medline data bank for English-language studies using the key words "menstruation" or "dysmenorrhea" associated with "environment" yielded 14 references to studies where women were exposed to pain or cold at various stages of their cycles in order to determine pain threshold variation and only one (our own) which studied environmental effects on menstrual symptoms. A contemporaneous search of the Medline medical data base using as keywords "dysmenorrhea," "menstrual disorders" and "premenstrual tension" associated with "industry" or "occupation" or "worker" or "working women" yielded no references in French or English and one reference to a study written in Chinese relating occupational risk factors to menstrual symptoms.[16]

Our original requests for funding for work relating working conditions to menstrual pain were refused. We did the research anyway,[17] and found that women who were exposed to cold and to lifting weights had more menstrual pain.[18] When we reported our results to the collaborating physicians they called the results "cute" [*amusant*], but suggested that publicizing the results would injure the scientific credibility of the

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[13] Woods, N.F., Most, A., Dery, G.K. 1982. Prevalence of premenstrual symptoms. American Journal of Public Health 72, 1257-64.

[14] Sundell, G., Milsom, I., & Anderson. 1990. Factors influencing the prevalence of dysmenorrhea in young women. British Journal of Obstetrics and Gynaecology 97: 588-94.

[15] Pullon, S., Reinken, J., & Sparrow, M. 1988. Prevalence of dysmennorhea in Wellington women,. New Zealand Medical Journal 10 February 1988: 52-54.

[16] Qu, Y. R. 1990. Chung-Hua- Yu-Fang-I-Hsueh-Tsa-Ching 1990 Sept 24(5):268-70.

[17] with the help of students

[18] Mergler Donna, Nicole Vézina. 1985. Dysmenorrhea and cold exposure. Journal of Reproductive Medicine 30:106-111.
Messing, Karen, Marie-Josèphe Saurel-Cubizolles, Monique Kaminski, Madeleine Bourgine. (1993) Factors associated with dysmenorrhea among workers in French poultry slaughterhouses and canneries. Journal of Occupational Medicine 35:493-500.
Messing, K., Saurel-Cubizolles, M.J., Kaminski, M., Bourgine, M. (1992) Menstrual cycle characteristics and working conditions in poultry slaughterhouses and canneries. Scandinavian Journal of Work, Environment and Health 18:302-309.

research team. This contempt for women's suffering was reflected in the tone of the comments we received when our requests for funding of studies of the effects of working conditions on dysmenorrhea were refused.

Calling this sort of willful ignorance objectivity also has repercussions for accuracy in describing occupational health in general. Back pain is an important parameter of occupational health. The prevalence of back pain has been determined in many jobs; for example, 70% of hospital workers (both sexes) report back pain in cross-sectional studies. At a given time, about 18% of women workers are menstruating, of whom about 60% have pain at menstruation in lower back area (our figures) but almost no studies of back pain ask whether subjects are menstruating. Since we have found that dysmenorrhea is not determined in the same way as other lower back pain, there is an important source of inaccuracy in understanding and prevention of factors leading to back pain.

Thus, a definition of objectivity centred on the perceptions of male scientists may prevent researchers from gaining critical knowledge of use to all workers. The emotional issue here is expertise. If scientists give credibility to workers they fear loss of prestige, loss of control of the research project.

Adjustment for relevant confounding variables or, how to hide bad working conditions[19]

Another example I will use to show that what passes for rigour may be merely shared prejudice comes from a common practice in occupational health research called "adjustment for confounders." "Adjusting" for a variable while analyzing data means using a mathematical procedure to eliminate its effect. It is reasonable, for example, to adjust for smoking when examining the relationship of dust exposure to lung damage. We examine the level of lung function among smokers and that among non-smokers in the entire sample, and add a correction factor to the lung function of smokers before testing the relationship between dust exposure and lung damage. This procedure allows us to determine the effect of dust on the lungs while taking into account the deleterious effects of smoking.

This procedure has been applied widely and abusively to sex differences (and racial differences). Studies which examine the health of workers often find that women workers report more symptoms of poor health or psychological distress than their male counterparts.[20] The methodological approach to these differences is to "adjust" for sex. The mathematical adjustment is never justified explicitly.[21] It would be justified only if the poorer health of women were a result of their sex, for example because they are weaker or because they complain more than men.

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[19] This section has profited from discussions with Donna Mergler.

[20] Brabant, Carole, Donna Mergler, Karen Messing. (1990). Va te faire soigner, ton usine est malade: La place de l'hystérie de masse dans la problématique de la santé au travail. Santé mentale au Québec. XV: 181-204.

But this is not necessarily the case. In a study of men and women workers in poultry processing plants,[22] women workers reported a higher prevalence of some symptoms (muscular and articular pain, stress-related disorders) than men, while other symptoms such as hearing difficulties had similar prevalences among the two sexes. In fact, noise levels were similar for men and women, but other aspects of their jobs differed. Women mainly worked standing still at the machine-paced assembly line; their work, which was carried out at very rapid speed, required swift, accurate arm and hand movements. Men's jobs allowed them more freedom of movement and were carried out at a less rapid pace. In areas of this workplace where men and women were doing similar jobs there were no differences in symptoms. Adjusting for gender in this study would have obscured the differences in working conditions and would have made it look as if the women reported more symptoms because they were complainers or weaker.

Data obtained from a health survey carried out in Québec[23] provide a good example of the consequences of adjusting for gender differences and grouping women's jobs. Among 6446 actively working men and 4053 actively working women between the ages of 18 and 65, a high psychological distress index[24] was observed for 9% of the men and 18% of the women, a highly significant difference. A committee of experts was asked by the Québec Mental Health Council to use this information for a document on mental health and the workplace.[25] Initial analyses adjusted for sex demonstrated that no women's jobs were associated with high levels of psychological stress. A feminist member of the committee succeeded after a long discussion in forcing a re-analysis of the data without adjusting for sex. This new analysis revealed that there were indeed several women's jobs associated with high levels of psychological distress.

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[21] For example, all the studies of carpal tunnel syndrome cited by Hagberg et al. (Hagberg, Mats, Hal Morgenstern, Michael Kelsh, 1992. Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome. Scandinavian Journal of Work Environment and Health 18:337-345. Table 2.) control for sex.

[22] Mergler, Donna, Carole Brabant, Nicole Vézina, Karen Messing. 1987 The weaker sex? Men in women's working conditions report similar health symptoms. Journal of Occupational Medicine 29:417-421.

[23] Enquête Santé Québec, 1988. Et la santé, ça va? Québec: Editeur officiel.

[24] Ilfeld, F. W. 1975. Methodological issues in relating psychiatric symptoms to social stressors. Psychology Reports 39: 1251-1258.

[25] Vézina, Michel, Michelle Cousineau, Donna Mergler, Alain Vinet. 1993. Pour donner un sens au travail. Québec: Comité de santé mentale.

Thus, the standard techniques originally used obscured the types of suffering women experience at their jobs, and help maintain the illusion that women are physically, mentally and emotionally "the weaker sex."[26] These prejudices act to reduce the amount of money allocated to prevent occupational disease in women.

Statistical significance, or why hurry to clean up the workplace

The supposedly objective nature of science thus poses problems for the identification and prevention of health risks for women. In addition, hidden political choices made by scientists can interfere with prevention of disease. The necessity for these choices arises from the fact that there is usually a rather long interval between the first doubts about particular working conditions and the time when the final word is in on the exact level of risk. For example, tens of thousands of women worked with video display terminals (VDTs) before the first study of VDT effects on pregnancy. Even now, no one is yet absolutely sure that VDTs do not pose a danger for pregnant women. But pregnant women have rarely stopped working with VDTs. In this and many other cases, a decision has been made to place the burden of proof on the worker rather than on the employer. That is, an agent must be proved dangerous before being removed.

The statistical tests conventionally used exaggerate this burden of proof. In order for scientists to accept the fact that Agent X causes problems for pregnancy, a study must establish the toxic effects with 95% certainty.[27] For scientists to be really sure, more than one study must show the same relationship. Given the small numbers of workers in most women's workplaces and the large numbers of potential hazards, it is no wonder that very few dangers for pregnancy or fertility have been established. A decision has been taken to put the burden of proof on the side of minimizing the costs of improvements in hygiene rather than on minimizing questionable exposures. This is a political decision but in the scientific literature it is presented as a scientific decision as to "the standard level of statistical significance," never questioned or explained.

The issue here is money: It is called "irresponsible" for scientists to insist on installing

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[26] The appropriate procedure is to analyse the data separately for both sexes, only considering them together if the same relationships appear to be operating in both sexes. See Eichler, Margrit. 1992. Nonsexist research: A metatheoretical approach. Indian Journal of Social Work 53(3):329-341.

[27] These decisions are often made by using "universal" criteria of statistical significance which, in fact, put the burden of proof on the worker and not the exposure. The usual level of significance accepted in epidemiological studies is 0.05. When a risk is accepted at the 0.05 level, this means that the researcher has only one chance in twenty of being wrong in concluding that there is a risk. A study which shows that the researcher would have one chance in ten of being wrong in concluding that there is a risk is considered to be "negative," that is, no risk has been demonstrated. This is true even if the group being studied is so small that there is virtually no chance of demonstrating anything. This point is discussed further in Messing, K. (1991) op. cit. Section 2.

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elaborate clean-up mechanisms before a risk has been scientifically established. In other words, the standard statistical techniques which place the burden of proof on pregnant women are used without explanation although they contain elements which can cause ill health among pregnant women.[28]

HOW CAN WE PROMOTE GENDER-INCLUSIVE SCIENCE AND TECHNOLOGY ?

Feminists have been suggesting new ground rules for over ten years.[29] We have been asking that androcentric science[30] give place to gender-inclusive science. That supposedly objective science contains prejudices about women's nature is yesterday's news. This paradigm shift, however, implies changes in the educational system, vocational training, product design and the research process. Demands for such radical changes encounter a great deal of ferocious opposition.

What do we do so that yesterday's news won't be tomorrow's news as well?

First, I think we have a lot of work to do in deciding what we want. I am referring to the "difference versus equality" arguments. The pioneering and important work of Gilligan[31] and Belenky et al.[32] have made us feel better about ourselves, no mean accomplishment. But they have also led to confusion and contradiction as feminists try to reconcile "difference" feminism with the fight for equality.

Women in science and technology have a particular responsibility to explore and respect the scientific underpinnings of our concepts, avoiding "essentialism" for example.[33] There are characteristics shared by all women: we can all be victims of rape, we are all perceived as inferior by sexists. There are characteristics shared in this time and place by most women and few men: most of us have or have had a disproportionate share in family responsibilities; most of us have trouble lifting very heavy weights. And there are average differences, also specific to time and place; we are on the average better listeners, more tentative in advancing ideas, more willing to collaborate and share. But we do not all have the characteristics of the average woman and it may be dangerous to suppose that we have.

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[28] Not only pregnant women are affected. Any powerless group (among which women are well represented) may have the burden of proof placed on it without justification.

[29] For example, see authors such as Louise Vandelac, Sue Sherwin, Abby Lippman, Maria De Koninck, Ruth Bleier, Ruth Hubbard, Ann Fausto-Sterling, Nancy Tuana, Elizabeth Fee, Gena Corea, Jeanne Stellman, Vilma Hunt, Wendy Chavkin, Linda Birke and many more. A partial bibliography is appended to this text.

[30] Research described above is androcentric. Androcentricity is not the only barrier to gender-inclusive research. In occupational health, there is also a problem because men are very often excluded from "gynocentric" studies of reproductive health. See Eichler, op. cit.

[31] Gilligan, Carole. 1982. In a Different Voice. Cambridge, USA: Harvard University Press.

[32] Belenky, Mary F., Blythe Clinchy, Nancy Goldberger, Jill Tarule. 1986. Women's Ways of Knowing. New York: Basic Books.

[33] Essentialism means attributing certain characteristics or behaviors to women's or men's "nature."

In fact, Melody Hessing recently pointed out that ecofeminist characterizations of the nature of women as essentially nurturing may have drawbacks both for the status of women and for the environment.[34] Not all women are protective, not all men are destructive, and protecting the environment requires dealing not with personal characteristics of individuals but with important structural problems and vested interests.

In our own work, refining our concepts has meant struggling with issues around women's and men's relative physical strength and fitness for non-traditional jobs.[35] An extreme "equality" view maintains that women and men have negligeable differences and women should be allowed full access to jobs lifting weights. An extreme "difference" view maintains that women should value their attributes of speed and precision and insist on equal pay while doing different tasks. A "liberal" view maintains that women and men should be tested to see whether they can do a particular job, and anyone who can do the job should be allowed to.

We started by examining the research results about strength and found that the average man can lift more weight than 95% of women, and that the average North American man is about 10% taller and heavier than the average woman. We then observed women doing non-traditional jobs. We discovered that there is no use in suggesting that all women should do men's jobs as they are now designed, many will only hurt themselves. We found that women were gradually eliminated from a package handling job which made heavy demands on smaller people.

Similarly, tools and equipment designed for the average man will make the average woman less efficient. A woman mechanic we studied, for example, was much better able to tighten bolts when she used a different wrench from her male co-worker. If she had used exactly the same tools and methods, she would have been less efficient and risked injury from forcing. She might eventually have been forced to leave her new job.

On the other hand, our observations of work have led us to question definitions of strength. Why is strength defined in terms of lifting weights rather than being able to put in a double workday?

The point of this example is that, even in the face of sexist denigrations of women's capacities, we cannot insist that women and men are mathematically equal. Rather, we have to move away from technology which favours men's bodies and techniques toward technology which takes into account human diversity. We have to devise tests for strength which will allow both women's and men's capacities to be shown to best advantage.[36] We may have to re-design jobs or consult working women to find out new ways to do them. We may even have to consider whether, in the current economic context, it is better to ask for equal salaries for women's and men's jobs rather than insisting that all jobs be immediately redesigned.

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[34] Hessing, Melody. 1993. Women and sustainability: Ecofeminist perspectives. Alternatives: Perspectives on society, Technology and Environment 19(1):14-21.

[35] The following discussion has profited from discussions with Joan Stevenson of Queen's University.

We will not be able to take generalized theoretical views on these questions, but will have to base ourselves on woman-based feminist research.

Thus, as we struggle for gender-inclusive science and technology, we must concentrate on taking appropriate account of our differences and of the social context in which they occur. The feminist critique of science and technology has to progress to include rules and practices for feminist research in these areas.[37]

WHAT ARE THE IMPLICATIONS OF GENDER-INCLUSIVE SCIENCE AND TECHNOLOGY FOR FEMINIST TEACHERS?

Because the power structures rarely divulge their secrets, students face confusing messages about women in science and technology. Programmes which propose to support women in science and technology rarely attack the two major obstacles to women's integration, family responsibilities and androcentric science and technology. My provincial government, which publishes brochures preaching science careers for young women, also cuts pregnant women students' access to financial aid and gives them one to four months after birth to go back to school before requiring that they start reimbursing the aid they had already received. One ministry has recently abolished special programmes in science education for women, saying that their purpose has been served, while another is initiating new programmes. A large public utility advertises the presence of young women in non-traditional jobs but distributes a pamphlet which mocks women who ask for women's bathrooms.

My university has an affirmative action clause in our collective agreement since 1979, and proudly submits an annual report describing their recruiting efforts.[38] However,

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[36] Stevenson, Joan. 1993. Fitting women into men's genes. Presented before the Royal Society of Canada. Montréal, June, 1993.

[37] The social context of technology is clearly set out in Ursula Franklin's (1990) The Real World of Technology. Toronto: CBC Enterprises. Rachelle Beauchamp, Maggie Benston, Cheris Kramarae, Maureen McNeil, Ellen Balka and many others have also written on this subject.

[38] The clause provides that if a woman and a man of equal competence apply to be professors, the woman will be hired.

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an initial rise in the proportion of women professors levelled off after 5 years, as departments argued that they had done their best but that no qualified women existed. Only 16.7% of natural science professors are women,[39] half the proportion among technicians and students in these departments.[40] The structural obstacles to integration of women are untouched. Because of difficulties in reconciling research with family responsibilities, women scientists in academia are still more than 6 times as likely as men to be unmarried.[41]

Students must be prepared to find the truth amid the propaganda and to attack the obstacles directly. As teachers we must make the social context of women's entry into science and technology clear to them.[42]

In order to train critical, thinking students, it is important for teachers to dissipate the clouds of glory surrounding science and technology which make it appear that these are fields above analysis by ordinary humans. We must give students a perspective on where science comes from, who it is for, and how this affects the way science is done and the results that are found. I think it is an error to try to attract young people into science and technology by showing them a laundered, idealized and ethereal vision of marvelous happenings. In fact, it is unscientific to present such an inaccurate and partial vision. Students who believe in fairy stories will not become good scientists.

Practical experiments give us a chance to put students in contact with real science. Scientists obtain a wealth of data which they select and refine to generate hypotheses. We test these hypotheses in experiments which may or may not work, or, most often, generate other hypotheses. Students may get the mistaken impression that scientists' experiments always give easy answers if the experiments presented in class always come out exactly as predicted. Students then don't see the continuity between their own scientific activities, such as figuring out what they should eat in order to feel good, and the activities officially labelled as scientific.

Another way that pedagogy can make students feel powerless in relation to science is when the student gets the impression that science is too difficult for all but the smartest people to understand. Validating students' visions is an essential part of feminist paedagogy. It is important to show students how science is involved with their own experiences such as cooking or walking.

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[39] Natural sciences are defined as biology, chemistry, earth sciences, mathematics and physics.

[40] See also Dagg, Anne Innis, 1990. Women in science - Are conditions improving? in Ainley, Marianne G. Despite the Odds:Essays on Canadian Women and Science. Montréal: Vehicule Press. pp. 337-347.

[41] Long, J. Scott. 1992. Measures of sex differences in scientific productivity. Social Forces 71:159-178.

[42] British authors Cockburn and Walkerdine make this particularly clear. See Cockburn, Cynthia. 1987. Two-track Training. London: Macmillan Education; Walkerdine, Valerie. 1989. Counting Girls Out. London: Virago Press.

Disempowerment and alienation result when scientific questions are not fully explained. Sometimes we as teachers don't understand something completely, so we explain it too fast in order to avoid questions. Sometimes we are pressed for time. It is easy to create an atmosphere which makes students reluctant to ask questions, and those who have been educated in science are often particularly docile. Once I saw a whole roomful of Ph. D.'s in genetics made completely silent by a puzzling explanation, given by a famous researcher in a scientific meeting. None of us dared to ask the question which would reveal that we had understood nothing at all. The researcher later told me he had been unclear on purpose because he did not want us to understand what he was doing, since he wanted to patent his process and make a lot of money. We all felt stupid, and he got away with his prestige and his secret!

Finally, I have found it to be extremely important to be explicitly feminist and to point out constantly the pitfalls which await women in science and technology. This is true even though the young women constantly assure me that the obtacles we old ladies experienced no longer exist. Students have told me that my words came back to them in later years once they were confronted by job-family conflicts or sexist employers. If I had not predicted their experiences they might have blamed themselves, particularly in the current context when there is so much propaganda regarding women's unlimited opportunities.

CONCLUSION

My mother always told me not to go alone into dangerous places. If we at CINBIOSE have been able to develop some gender-inclusive methods and make concrete contibutions to women's occupational health, it is because we have been in a situation where we could develop links among ourselves, with other women scientists through UQAM's feminist research institute, and with women workers through UQAM's agreements with trade unions. Support and solidarity have been absolutely essential, especially when the power struggles have us on the ropes.

It is very important to teach students how to develop these links, which are important sources of ideas as well as support. Women students, scientific and technical workers and teachers need spaces where they can share their doubts about their own contributions, their strange new ideas, their struggles for respect and their victories. GASAT is such a space, and I'm looking forward to sharing it for the next five days.

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CHOCS ÉLECTRIQUES ET CHOCS CULTURELS : DES RISQUES POUR LES FEMMES QUI ENTRENT DANS LES DOMAINES DES SCIENCES ET DE LA TECHNOLOGIE

Karen Messing
Centre pour l'étude des interactions biologiques entre la santé et l'environnement
Université du Québec à Montréal

INTRODUCTION

Une femme nous a parlé de son premier emploi en tant qu'électricienne au sein d'une société multinationale. Elle a accepté ce poste il y a cinq ans et était la seule femme parmi 80 électriciens dans l'usine (elle l'est d'ailleurs toujours). On lui a désigné un partenaire, un homme n'appréciant guère l'idée de travailler avec une femme. Il a tout fait pour lui rendre la vie dure, du refus de lui expliquer certaines choses aux commentaires désagréables sur son apparence. Puisque son travail lui plaisait et qu'elle n'avait pas trop envie de se plaindre, elle a encaissé cette attitude sans dire un mot. Un jour, toujours avec l'intention de se débarrasser d'elle, il changea les fils d'un circuit sur lequel elle devait travailler. Si elle n'avait pas découvert sa supercherie à temps, elle aurait reçu un choc électrique qui aurait pu la blesser gravement. On accepta alors sa requête pour obtenir un nouveau partenaire. Son premier partenaire, lui travaille toujours au sein de la compagnie.

C'est un des aspects de l'histoire. L'autre aspect est la satisfaction totale que cette femme éprouve pour son travail. Cette femme est mère seule soutien de trois enfants et est fière de gagner suffisamment d'argent pour pouvoir prendre soin d'eux, beaucoup mieux d'ailleurs que la plupart des femmes assumant des responsabilités similaires. Quand elle attendait son premier enfant, elle a refusé de prendre le congé auquel elle avait droit, sous prétexte qu'elle se serait ennuyée à la maison à ne rien faire. Elle travailla jusqu'au jour de son accouchement.[1]

De telles situations sont chose courante. D'un côté, nous avons les très fortes émotions en plus des actions radicales à l'égard des femmes qui essaient et qui veulent occuper un emploi non traditionnel. De l'autre côté, nous avons les importants avantages financiers et personnels pour les femmes qui réussissent dans ces emplois.

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[1] Emond, Carole, Louise Thiffault. 1992. Étude d'un poste de travail non traditionnel. Document soumis pour le cours BIO 1550, Université du Québec à Montréal.

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Les enjeux sont importants et, à une époque comme la nôtre, ils le sont de plus en plus. Mentionnons que la défense des bastions du pouvoir ne s'arrête pas aux cols bleus. Je suis certaine que toutes les femmes ici aujourd'hui ont été confrontées à un moment ou à un autre au terrible choc de découvrir quelles armes disproportionnellement puissantes certaines personnes utilisent pour relever le plus petit défi menant au pouvoir. Nous-mêmes avons pour la première fois mentionné le sexisme dans une réunion départementale en 1978. La réunion s'est terminée dans notre bureau, avec les professeurs masculins tapant et criant à la porte. Dans notre faculté des sciences, qui compte 83 % d'hommes, les femmes font face à la même hostilité que dans les emplois manuels, mais au lieu d'être soumises à des obscénités et de risquer un choc électrique, on nous rabat les oreilles avec l'excellence, la qualité, la rigueur et les normes. Ces mots sont fort séduisants... des frissons me parcourent l'épine dorsale chaque fois que je m'efforce d'être excellente et rigoureuse. Toutefois, ces mots sont utilisés pour encourager les entreprises à ne pas embaucher des femmes, à ne pas accorder le temps nécessaire aux travailleuses scientifiques pour assumer leurs responsabilités familiales, à empêcher l'équité des sexes dans la recherche et à ne pas inclure dans le programme 33 d'études, des sujets qui intéressent les femmes. Et l'émotion qui règne a la même intensité que dans l'usine.

Ainsi, je ne veux pas qu'en m'écoutant parler de certaines des questions auxquels font face les femmes qui entrent et transforment les domaines des sciences et de la technologie, on oublie le fait que nous parlons ici de pouvoir - de pouvoir économique et social. Et le changement donne du pouvoir à certains nouveaux groupes pour en retirer à d'autres, qui, cela va de soi, luttent pour le récupérer.

La violence à laquelle nous sommes confrontées peut prendre une forme explicite, telle que les chocs électriques, ou être plus subtile, comme dans les situations où des femmes qualifiées sont ignorées ou traitées comme si elles n'existaient pas.[2] Elle peut aussi être invisible: des domaines d'étude complets ont été développés en relation avec les corps, les modèles de vie et les intérêts d'un sexe unique, qui est considéré comme la norme, alors que le corps des femmes et leurs modèles de vie et intérêts sont rarement considérés, ou traité en marge. Des règlements sont ensuite élaborés pour définir des normes telles que l'excellence, la qualité et la rigueur. Les conséquences de telles normes peuvent être graves : exclusion des femmes et des questions qui les concernent, perte d'information, retard à résoudre certains problèmes et souffrance humaine. Je vais vous donner quelques exemples sur les effets des sciences "androcentriques" tirés de mon propre secteur de santé au travail. Je vais tenter de démontrer ici combien les questions de pouvoir dans le domaine de la santé au travail se déguisent en questions de pure pratique scientifique.

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[2] Tancred, Peta et Susan Czarnocki. 1993. «The revolving door: women's exit from non-traditional work». Dans Martens, Debra (éd.) Weaving Alliances. Ottawa : Association canadienne des études sur les femmes.

QUESTIONS DE POUVOIR ET ÉTUDE ANDROCENTRIQUE DE LA SANTÉ AU TRAVAIL

Il existe une division sexuelle au sein du marché du travail. Et même si le même emploi a souvent été attribué à des femmes à un endroit et à un moment donné, et à des hommes quelques années plus tard ou quelques kilomètres plus loin, une division sexuelle des emplois existe depuis des centaines d'années.[3] On a calculé que pour que les sexes soient équitablement répartis dans tous les titres d'emploi en Amérique du Nord, deux tiers des hommes et deux tiers des femmes devraient changer d'emploi.[4] Les femmes travaillent principalement dans le secteur tertiaire, alors que les hommes travaillent dans une variété de secteurs, allant de l'agriculture à l'exploitation minière, de la production, à la construction et aux emplois tertiaires. En outre, les femmes se retrouvent dans de plus petits milieux de travail, comptant moins de 50 employés.

Ainsi, les emplois des femmes sont différents des emplois des hommes. Jusqu'à maintenant, l'intervention et la recherche en matière de santé au travail a presque toujours touché les emplois occupés par des hommes. Les hommes sont plus souvent compensés pour des maladies professionnelles et moins de 10 % des travailleurs québecois qui se retrouvent dans des domaines ou l'intervention en santé au travail est priorisé, sont des femmes. A mon avis, ce phénomène n'est pas dû au fait que les femmes courent moins de risques dans leurs emplois, mais plutôt au fait que les concepts de la santé au travail découlent de l'examen des emplois occupés par les hommes. J'ai choisi de vous donner quelques exemples détaillés plutôt que de couvrir une large gamme d'exemples possibles.[5]

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[3] Bradley, Harriet. 1989. Men's Work, Women's Work. Minneapolis: University of Minnesota Press.

[4] David, Hélène. 1986. Femmes et emploi : le défi de l'égalité. Montréal : Presses de l'Université du Québec.

[5] On discute plus en détail de ces questions dans les publications suivantes :

Messing, Karen, Lucie Dumais, Patrizia Romito. (1992) «Prostitutes and chimney sweeps both have problems: Toward full integration of the two sexes in the study of occupational health». Social Science and Medicine 36:47-55.

a) La nécessité de l'uniformité de la population ou… femmes, gardez vos distances!

Les chercheurs insistent pour que les échantillons de populations examinées soient «uniformes». Il est intéressant de constater quels critères rendent les sous-populations non uniformes. Dans la recherche sur le cancer, on peut parvenir à l'uniformité en exigeant des sujets à l'étude qu'ils partagent le même environnement urbain ou rural, les mêmes habitudes d'alimentation ou les mêmes antécédents médicaux. Toutefois, les femmes sont fréquemment éliminées par ces critères. Par exemple, en 1988, Block et ses collègues ont publié une étude sur le cancer chez les travailleurs exposés au phosphate dans une usine d'engrais.[6] Parmi 3 400 employés, 173 femmes ont été éliminées avec, comme seul commentaire, «parce que les femmes ne constituent que 5 % de la population à l'étude, elles n'ont pas été incluses dans les analyses». Toutefois, on n'a pas considéré que les 38 travailleurs masculins du service du séchage et de l'expédition étaient en trop petit nombre pour les inclure à l'étude : une augmentation significative de leur taux de mortalité a été remarquée.

Un autre exemple est l'étude, qui a couté plus de 2 millions de dollars, aux fonds publics, reliant certains cancers à un nombre incroyable d'expositions professionnelles. Lorsqu'on a demandé pourquoi les femmes avaient été exclues de l'étude, le chercheur a répondu : «C'est une analyse coût-bénéfice; les femmes ne contractent pas beaucoup de cancers professionnels». Il n'a pas réagi lorsqu'on lui a fait remarquer que son raisonnement était circulaire, pas plus lorsqu'on lui a fait remarquer que pour les femmes contribuables, le rapport coût-bénéfice d'une étude les excluant était infiniment plus élevé. Les documents publiés à la suite de cette étude dans des revues évaluées par

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Messing, K. (1991). «Occupational Health and Safety Concerns of Canadian Women: A review/Santé et sécurité des travailleuses : un document de base». Ottawa : Travail Canada. 110 pages.

Dumais, Lucie et Karen Messing. (1991) La science et le corps des femmes. Dans Mura, R. Un savoir à notre image : Les critiques féministes des disciplines. Adage, Montréal. pp. 107-122.

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Messing, K. et Donna Mergler. (à paraître). «The rat couldn't speak, but we can: Inhumanity in occupational health research». Dans Hubbard, Ruth et Linda Birke Re-inventing Biology.

[6] Block, Gladys, Genevieve Matanoski, Raymond Seltser, Thomas Mitchell. 1988. «Cancer morbidity and mortality in phosphate workers». Cancer Research 48:7298-7303. Un exemple parmi tant d'autres.

des pairs n'ont même pas jugé bon d'expliquer pourquoi les femmes avaient été exclues.[7] Bien d'autres exemples récents existent dans la recherche sur la santé au travail n'incluant que des hommes, sans justification.

En fait, on retrouve certains cancers professionnels chez les femmes. Une étude des membres de l'American Chemical Association démontre que les femmes ont des taux de cancer des ovaires et du sein significativement élevés.[8] Une étude canadienne a également révélé que les coiffeuses étaient particulièrement enclines à contracter la leucémie et le cancer des ovaires.[9] Malheureusement, nous manquons largement de renseignements pertinents dans ce domaine.

L'élimination des femmes dans les études sur les cancers professionnels renforce la notion que les femmes courent moins de risques dans leurs emplois et que les préoccupations des femmes relatives aux influences environnementales sur le cancer du sein (par exemple) ne sont pas fondées. Il devient donc justifiable d'exclure les emplois où l'on retrouve des femmes des efforts de prévention.

Ainsi, les femmes sont souvent et injustement privées des fonds de l'État en matière de recherche et de l'information sur leur santé au nom d'une «bonne» pratique scientifique. À se demander pour qui cette pratique est «bonne»?

La nécessité d'être objectif, ou comment faire la sourde oreille aux voix des femmes

Les problèmes à l'étude sont censés être documentés de façon objective. Qu'est-ce que cela peut bien vouloir dire? Qui peut être considéré comme étant objectif? Afin d'établir un lien entre les conditions de travail et la maladie, les chercheurs se réfèrent à des «experts», comme dans l'exemple suivant, repris d'un article scientifique sur la santé au travail. Dans une étude effectuée auprès de 13 568 travailleurs, on a demandé à des experts de classer certains emplois comme étant exposés à la poussière ou pas. Les chercheurs ont justifié leur étude comme suit : «Bien [qu'une estimation de l'exposition

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[7] Siemiatycki, Jack, Ron Dewar, Ramzan Lakhani, Louise Nadon, Lesley Richardson, Michel Gérin. «Cancer risks associated with 10 organic dusts: Results from a case-control study in Montréal». American Journal of Industrial Medicine 16:547-567.

[8] Walrath, J., Li, F.P., Hoar, S.K. 1985. «Causes of death among female chemists». American Journal of Public Health 75:883-885.

[9] Spinelli, J.J., Gallagher, R.P., Band, P.R., Threlfall, W. J. 1984. «Multiple myeloma leukemia and cancer of the ovary in cosmetologists and hairdressers». American Journal of Industrial Medicine 6:97-102.

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par les experts] ne puisse constituer une référence idéale, elle n'est pas faussée par de mauvaises classifications de l'exposition selon des facteurs personnels étant donné qu'elle est basée seulement sur des titres d'emploi et des secteurs industriels».[10] Cette étude a mis en corrélation les symptômes signalés d'exposition à la poussière (troubles respiratoires, asthme) avec les évaluations des experts et des travailleurs sur l'exposition à la poussière. La corrélation entre les rapport des travailleurs et les symptômes était beacoup plus élèvé que ceux des experts. En fait, pour les travailleuses et pour les travailleurs ayant un niveau moins élevé d'instruction, la corrélation avec celles des experts semblait relativement faible. Les chercheurs en ont-ils conclu que les estimations des experts étaient incomplètes, biaisés selon l'appartenance de classe sociale, faussement appliquées aux emplois des femmes ou simplement désuètes? Pas du tout! «Les facteurs modifiant la force de l'association entre deux estimations de l'exposition (experts vs travailleurs) sont des biais potentiels de rappel de l'exposition. Cette association était beaucoup plus forte chez les hommes que chez les femmes, suggérant une meilleure perception de l'exposition par les hommes...» En d'autres termes, si l'exposition signalée par les travailleurs était en plus étroite corrélation avec les symptômes que l'exposition signalée par les experts, les rapports des travailleurs sur l'exposition et les symptômes étaient erronés. Si les hommes éduqués étaient plus près des experts, alors les hommes avaient fait moins d'erreurs que les femmes ou les moins éduqués.

Mais en fait, il n'y a aucune raison de croire qu'un «expert» qui n'a jamais été dans un lieu de travail particulier puisse, mieux qu'un travailleur, décrire l'exposition à la poussière, à l'aide de tables d'exposition élaborées 7 ans plus tôt dans un autre pays. Nous avons toutes les raisons de croire que les experts sous-estiment constamment l'exposition des femmes et leurs problèmes de santé.

La question des douleurs menstruelles est un autre exemple. Je vous présente ici un scientifique «objectif» publiant un article sur les douleurs menstruelles des hôtesses de l'air dans une revue scientifique reconnue : «Il est ressorti des discussions qui ont accompagné l'examen médical annuel des hôtesses, que certaines de ces filles sont de plus en plus anxieuses en raison de [articles parus dans des journaux sur les effets des transports aériens sur la santé des hôtesses de l'air]... Examinons l'affirmation que les transports aériens, et plus particulièrement les avions à réaction, aient un effet nuisible sur les fonctions menstruelles des hôtesses... Lorsqu'on étudie les tables individuelles [avec les résultats de cet auteur], on constate que l'effet le plus important était l'irrégularité, suivi de la dysménorrhée. L'irrégularité est un effet tout à fait normal (vu les décalages horaires); toutefois, la dysménorrhée est impossible à mesurer, étant hautement subjective, et il semblerait que l'aspect psychologique ait ici la plus grande importance».[11]

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[10] Hsairi, Mohammed, Francine Kauffmann, Michel Chavance, Michel et Patrick Brochard. 1992. «Personal factors related to the perception of occupational exposure: An application of a job exposure matrix». Int. Epidemiol. Assoc. 21:972-980.

Dans un article plus récent sur le même sujet, paru dans le même journal, d'autres chercheurs ont indiqué que les hôtesses de l'air débutantes éprouvaient 3,5 fois plus de changements défavorables dans leur cycle menstruel que de changements positifs. «Nous n'avons pas assez d'information pour expliquer la pathophysiologie de la dysménorrhée. L'association fréquente de la dysménorrhée à d'autres symptômes névrotiques est indicatrice de son origine psychologique».[12]

En d'autres termes, lorsque le scientifique peut comprendre le résultat, ce dernier est objectif. Lorsqu'il ne peut le comprendre, il est subjectif. Ce manque de respect à l'égard des perceptions des femmes a un effet extrêmement nuisible sur la santé des femmes. Plus de la moitié des Européennes et des Nord-américaines en âge d'avoir des enfants ont un emploi, et entre 30 et 90 % des femmes indiquent souffrir de douleurs abdominales et lombaires pendant leurs règles.[13,14,15] Toutefois, la littérature occidentale sur la santé au travail n'inclut presque jamais les symptômes menstruels dans les variables à l'étude. Une recherche effectuée de la banque de données Medline pour les études en langue anglaise, publiées entre 1975 et 1991 à l'aide des mots clés «menstruation» et «dysménorrhée» associés au mot «environnement» a donné 14 références d'études dans le cadre desquelles, des femmes avaient été exposées à la douleur et au froid à diverses étapes de leur cycle pour déterminer le seuil de la douleur, et seulement une (venant du CINBIOSE) qui étudiait les effets environnementaux sur les symptômes menstruels. Une recherche contemporaine à l'aide des mots clés «dysménorrhée», «troubles menstruels» et «tension prémenstruelle» associés à «industrie» ou «occupation» ou «travailleuse» n'a donné aucune référence en français ou en anglais et une référence à une étude chinoise sur les facteurs de risques professionnels des symptômes menstruels.[16]

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[11] Cameron, R. G. 1969. «Effect of flying on the menstrual function of air hostesses». Aerospace Medicine. Septembre 1969:1020-23.

[12] Iglesias, RE. Terrés, A., Chavarria, A. 1980. «Disorders of the menstrual cycle in airline stewardesses». Aviation, Space and Environmental Medicine. Mai 1980. 518-20.

[13] Woods, N.F., Most, A., Dery, C.K. 1982. «Prevalence of premenstrual symptoms». American Journal of Public Health. 72, 1257-64.

[14] Sundell, G., Milsom, I., & Anderson. 1990. «Factors influencing the prevalence of dysmenorrhea in young women». British Journal of Obstetrics and Gynaecology. 97, 588-94.

[15] Pullon, S., Reinken, J., & Sparrow, M. 1988. «Prevalence of dysmennorhea in Wellington women», New Zealand Medical Journal. 10 février 1988:52-54.

Nos demandes initiales de financement pour des recherches sur un rapport possible entre les conditions de travail et les douleurs menstruelles ont toutes été refusées. Nous avons malgré tout procédé à la recherche [17], et nous avons découvert que les femmes qui avaient été exposées au froid et à qui on avait demandé de soulever des poids, avaient eu plus de douleurs menstruelles.[18] Lorsque nous avons rapporté nos résultats aux médecins ayant collaboré à l'étude, ils les qualifièrent «d'amusants» et suggérèrent que le fait de publier de tels résultats constituerait une injure à la crédibilité scientifique de l'équipe de recherche. Ce manque de respect à l'égard de la souffrance des femmes s'est reflété dans le ton des commentaires que nous avons reçus lorsqu'on nous a refusé les fonds pour étudier les effets des conditions de travail sur la dysménorrhée.

Qualifier ce type d'ignorance intentionnelle d'objectivité comporte également des répercussions sur l'exactitude à décrire les effets du travail sur la santé en général. Les maux de dos sont un aspect important de la santé au travail. La prévalence des maux de dos a été établie dans un grand nombre d'emplois; par exemple, 70 % des travailleuses et travailleurs d'hôpitaux indiquent souffrir de maux de dos dans des études transversales. À n'importe quel moment donné, environ 18 % des travailleuses ont leurs règles. Environ 60 % d'entre elles souffrent de douleurs dans la région lombaire (nos chiffres), mais presqu'aucune étude sur les maux de dos ne demande aux femmes si elles sont menstruées ou pas. Étant donné que nous avons découvert que la dysménorrhée n'est pas causée par les mêmes facteurs que les douleurs lombaires, il existe une source importante d'inexactitude dans la compréhension et la prévention des facteurs responsables des maux de dos.

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[16] Qu, Y.R. 1990. Chung-Hua- Yu-Fang-I-Hsueh-Tsa-Ching 1990 Sept 24(5):268-70.

[17] avec l'aide d'étudiantes.

[18] Mergler Donna, Nicole Vézina. 1985. «Dysmenorrhea and cold exposure». Journal of Reproductive Medicine 30:106-111.

Messing, Karen, Marie-Josèphe Saurel-Cubizolles, Monique Kaminski, Madeleine Bourgine. (1993) «Factors associated with dysmenorrhea among workers in French poultry slaughterhouses and canneries». Journal of Occupational Medicine 35:493-500.

Messing, K., Suarel-Cubizolles, M.J., Kaminski, M., Bourgine, M. (1992) «Menstrual cycle characteristics and working conditions in poultry slaughterhouses and canneries». Scandinavian Journal of Work, Environment and Health 18:302-309.

Ainsi, une définition de l'objectivité axée sur les perceptions des hommes scientifiques peut empêcher les chercheures et les chercheurs d'acquérir des connaissances critiques, utiles à toutes les travailleuses et à tous les travailleurs. L'aspect émotionnel ici est l'expertise. En accordant de la crédibilité aux commentaires des travailleurs, les chercheures et chercheurs ont souvent l'impression de perdre leur prestige et contrôle sur le projet de recherche.

Ajustement des variables de confusion pertinentes, ou comment dissimuler de mauvaises conditions de travail[19]

Un autre exemple que j'utiliserai pour démontrer que ce que l'on fait passer pour de la rigueur peut en fait être simplement un préjudice commun provenant d'une pratique courante dans la recherche sur la santé au travail appelée «ajustement sur des facteurs de confusion». «Ajuster» une variable pendant qu'on analyse les données signifie avoir recours à une méthode mathématique pour éliminer ses effets. Il est raisonnable, par exemple, d'ajuster pour le tabagisme lorsqu'on étudie la relation entre l'exposition à la poussière et les dommages aux poumons. On examine le niveau de la fonction respiratoire chez les fumeurs et chez les non-fumeurs dans l'échantillon au complet, puis on ajoute un facteur de correction à la fonction respiratoire des fumeurs avant de tester la relation entre l'exposition à la poussière et les dommages aux poumons. Cette méthode nous permet de déterminer l'effet de la poussière sur les poumons tout en tenant compte des effets nocifs du tabagisme.

Cette méthode a largement, et de façon abusive, été appliquée aux différences sexuelles (ainsi qu'aux différences raciales). Les études qui examinent la santé au travail révèlent souvent que les femmes signalent plus de symptômes de santé ou de troubles psychologiques que leurs collègues masculins.[20] L'approche méthodologique pour tenir compte de ces différences est de faire un «ajustement» pour le facteur sexe. L'ajustement mathématique n'est jamais justifié de façon explicite.[21] Il ne peut être justifié que si la santé plus médiocre des femmes est un résultat de leur sexe, par

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[19] Cette section est tirée de nos discussions avec Donna Mergler.

[20] Brabant, Carole, Donna Mergler, Karen Messing. (1990). «Va te faire soigner, ton usine est malade : La place de l'hystérie de masse dans la problématique de la santé au travail». Santé mentale au Québec. XV:181-204.

[21] Par exemple, toutes les études sur le syndrome du canal carpien citées par Hagberg et al (Hagberg, Mats, Hal Morgenstern, Michael Kelsh, 1992. «Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome». Scandinavian Journal of Work Environment and Health 18:337-345. Tableau 2.) Contrôle pour le sexe.

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exemple parce qu'elles sont plus faibles ou parce qu'elles ont tendance à se plaindre plus souvent que les hommes.

Mais ce n'est pas nécessairement le cas. Dans une étude effectuée auprès d'un groupe de travailleuses et de travailleurs au sein d'établissements de transformation de la volaille,[22] les femmes ont signalé une prévalence plus forte de certains symptômes (douleurs musculaires et articulaires, troubles reliés au stress) que les hommes, alors que la prévalence d'autres symptômes tels que les troubles de l'ouïe était similaire chez les deux sexes. En fait, les niveaux de bruit étaient semblables pour les hommes et les femmes, mais d'autres aspects de leur emploi étaient différents. Les femmes travaillaient principalement debout, des bras et des mains à la chaîne de montage; leur travail demandant une extrême dextérité, exigeait des movements précis et rapides des bras et des mains. Les emplois où l'on retrouvaient les travailleurs restreignaient moins les mouvements et n'exigeaient pas une aussi grande rapidité. Dans les zones de ce milieu de travail où les hommes et les femmes accomplissaient des tâches semblables, aucune différence n'a été constatée dans les symptômes. Ajuster l'étude pour tenir compte du sexe dans ce cas particulier aurait masqué les différences dans les conditions de travail et aurait fait croire que les femmes signalent davantage de symptômes parce qu'elles aiment davantage se plaindre ou sont plus faibles.

Les données recueillies lors d'un sondage sur la santé effectué au Québec,[23] fournissent un bon exemple des conséquences d'ajustement sur le sexe et du regroupement des emplois féminins. Parmi 6 446 hommes actifs et 4 053 femmes actives entre 18 et 65 ans, un indice élevé de détresse psychologique[24] a été observé chez 9 % des hommes et chez 18 % des femmes, ce qui constitue une différence considérable. Le Comité de santé mentale du Québec a demandé à un comité d'experts d'utiliser cette information pour rédiger un document sur la santé mentale et le milieu de travail.[25] Les premières analyses ayant fait l'ajustement pour le sexe ont révélé qu'aucun emploi féminin n'était associé à de hauts niveaux de stress psychologique. Une membre féministe du comité a réussi, après de longues discussions, à forcer le comité à réanalyser les données sans ajuster pour le sexe. Cette nouvelle analyse a révélé qu'il existait effectivement des emplois féminins associés à de hauts niveaux de stress psychologique.

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[22] Mergler, Donna, Carole Brabant, Nicole Vézina, Karen Messing. 1987. «The weaker sex? Men in women's working conditions report similar health symptoms». Journal of Occupational Medicine 29:417-421.

[23] Enquête Santé Québec, 1988. Et la santé, ça va? Québec : Éditeur officiel.

[24] Ilfeld, F. W. 1975. «Methodological issues in relating psychiatric symptoms to social stressors». Psychological Reports 39:1251-1258.

[25] Vézina, Michel, Michelle Cousineau, Donna Mergler, Alain Vinet. 1993. Pour donner un sens au travail. Québec : Comité de santé mentale.

Ainsi, les techniques standard communément utilisées masquent les types de souffrance dont sont victimes les femmes dans le cadre de leur travail, et aident à maintenir l'illusion que les femmes sont physiquement, mentalement et émotionnellement «plus faibles».[26] Ces préjugés contribuent à la réduction des fonds disponibles pour la reconnaissance et la prévention des maladies professionnelles chez les femmes.

Importance statistique, ou pourquoi se hâter à «décontaminer» le milieu de travail

La nature prétendument objective des sciences pose ainsi des problèmes à l'identification et à la prévention des risques pour la santé des femmes. D'autre part, les choix politiques implicites des scientifiques peuvent interférer avec la prévention de la maladie. La nécessité de ces choix provient du fait qu'il s'écoule habituellement un laps de temps considérable entre les premiers doutes à propos de conditions de travail particulières et l'établissement final du niveau de risque. Par exemple, des dizaines de milliers de femmes avaient travaillé avec des terminaux à écran cathodique avant que la première étude sur les effets de ces terminaux sur la grossesse ne soit effectuée. Même aujourd'hui, personne n'est encore absolument certain que les terminaux à écran cathodique ne posent aucun danger pour la santé des femmes enceintes. Toutefois, celles-ci continuent à travailler sur ce genre de terminaux. Dans ce cas, et dans beaucoup d'autres, une décision a été prise pour mettre le fardeau de la preuve sur la travailleuse plutôt que sur l'employeur. Ainsi, elle doit prouver qu'un agent est dangereux avant qu'on ne puisse le retirer du milieu de travail.

Les tests statistiques conventionnellement utilisés exagèrent ce fardeau de la preuve. Pour que les scientifiques acceptent le fait que l'agent X pose des problèmes pendant la grossesse, une étude doit établir les effets toxiques avec une certitude de 95 %.[27] Pour que les scientifiques soient vraiment sûrs de leur coup, plus d'une étude doit démontrer la même relation. Étant donné le nombre restreint de travailleuses dans la plupart des milieux de travail féminins et le grand nombre de risques potentiels, il n'est pas étonnant qu'on soit parvenu à établir l'existence que d'un nombre très restreint de dangers pour la grossesse ou la fertilité. Une décision a été prise de mettre le fardeau de la preuve sur la minimisation des coûts de l'amélioration de l'hygiène, plutôt que sur la minimisation des expositions suspectes. Cette décision est une décision politique, mais qui, dans la littérature scientifique, est présentée comme une décision scientifique ayant trait au «niveau standard de significativité statistique», jamais remise en question et jamais expliquée.

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[26] La méthode appropriée est d'analyser les données séparément pour les deux sexes et de ne les considérer ensemble que si les mêmes relations semblent exister chez les deux sexes. Voir Eichler, Margrit. 1992. «Nonsexist research: A metatheoretical approach». Indian Journal of Social Work 53(3):329-341.

[27] Ces décisions sont souvent prises sur la base de critères «universels» statistiquement significatif qui, en fait, mettent le fardeau de la preuve sur la travailleuse et non pas sur l'exposition. Le niveau habituel significativité statistique accepté dans les études épidémiologiques est de 0,05. Lorsqu'un risque est accepté au niveau de 0,05, cela signifie que la chercheuse ou le chercheur n'a qu'une seule chance sur vingt de se tromper dans sa conclusion qu'il y a un risque. Une étude qui démontre que la chercheuse ou le chercheur aurait une chance sur dix de se tromper dans sa conclusion qu'il existe un risque est considérée comme «négative», c'est-à-dire, qu'aucun risque n'a été démontré. Ceci est

Le problème ici, c'est l'argent. Les travailleurs scientifiques sont qualifiés d'irresponsables lorsqu'ils insistent pour installer des mécanismes de «nettoyage» élaborés avant qu'un risque n'ait été établi scientifiquement. En d'autres termes, les techniques statistiques standard qui mettent le fardeau de la preuve sur les femmes porteuses d'un enfant sont utilisées sans explication, malgré qu'elles contiennent des éléments qui peuvent rendre malades les femmes enceintes.[28]

COMMENT PROMOUVOIR L'ÉQUITÉ DES SEXES DANS LES SCIENCES ET DELA TECHNOLOGIE?

Des féministes proposent de nouvelles règles de base depuis plus de dix ans maintenant.[29] Nous demandons que les sciences androcentriques[30] cèdent leur place à des sciences équitables pour les deux sexes. Le fait que cette science prétendument

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vrai même si le groupe à l'étude est si petit qu'il n'y a quasiment aucune chance de démontrer quoi que ce soit. Ce point est repris plus en détail dans Messing, K. (1991) op.cit. cit.

[28] Ce ne sont pas que les femmes enceintes qui sont concernées. Tous les groupes privés de pouvoir (parmi lesquels les femmes sont bien représentées) peuvent se voir attribuer le fardeau de la preuve sans justification.

[29] Par exemple, voir les ouvrages d'auteures telles que Louise Vandelac, Sue Sherwin, Abby Lippman, Maria De Koninck, Ruth Bleier, Ruth Hubbard, Ann Fausto-Sterling, Nancy Tuana, Elizabeth Fee, Gena Corea, Jeanne Stellman, Vilma Hunt, Wendy Chavkin, Linda Birke et bien d'autres. Une bibliographie partielle est annexée à ce document.

[30] L'étude décrite ci-dessus est androcentrique. L'androcentricité n'est pas la seule barrière à l'équité des sexes dans la recherche. Dans le domaine de la santé au travail, on est également confronté au fait que les hommes sont souvent exclus des études «gynocentriques» sur l'hygiène de la reproduction. Voir Eichler, op. cit.

objective contienne des préjugés quant à la nature des femmes ne date pas d'hier. Ce changement de paradigme, toutefois, implique des changements dans le système de l'éducation, la formation professionnelle, la conception des produits et les méthodes de recherche. Les demandes en vue de tels changements rencontrent souvent une opposition féroce.

Que faire pour ne pas toujours répéter les mêmes erreurs?

Tout d'abord, je pense que nous avons beaucoup à faire avant de pouvoir établir ce que nous voulons vraiment. Je me réfère à la controverse «différence versus égalité». Les travaux importants et d'avant-garde de Gilligan[31] et Belenky et al.[32] nous ont permis de nous sentir beaucoup mieux avec nous-mêmes. Toutefois, ils ont aussi entraîné confusion et contradictions pendant que des féministes tentaient de rapprocher le féminisme de la «différence» à la lutte pour l'égalité.

Les femmes dans les sciences et la technologie ont la responsabilité particulière d'explorer et de respecter les fondements scientifiques qui soutiennent nos concepts, en évitant, par exemple, «l'essentialisme».[33] Les femmes partagent toutes certaines caractéristiques : nous pouvons toutes être victimes d'un viol, nous sommes toutes perçues comme étant un groupe inférieur par ceux qui sont sexistes. La plupart des femmes, et quelques hommes aussi, partagent certaines caractéristiques suivant l'époque et l'endroit : la plupart d'entre nous connaissons ou avons connu un partage disproportionné dans les responsabilités familiales; la plupart d'entre nous avons de la difficulté à soulever des objets très lourds. Et il existe des différences moyennes, également spécifiques à l'époque et à l'endroit; en général, nous, les femmes, écoutons mieux, nous sommes plus enclines à présenter nos idées, plus désireuses de collaborer et de partager. Mais nous n'avons pas toutes les caractéristiques de la femme moyenne et il peut être dangereux de supposer que nous les avons.

En fait, Melody Hessing a récemment souligné que les caractérisations écoféministes de la nature essentiellement nourricière des femmes peuvent avoir des effets nuisibles sur le statut des femmes et sur l'environnement.[34] Les femmes ne sont pas toutes protectrices, les hommes ne sont pas tous destructifs, et protéger l'environnement exige de s'attarder non pas sur les traits personnels des individus, mais plutôt sur les problèmes structuraux et les droits acquis.

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[31] Gilligan, Carole. 1982. In a different voice. Cambridge, É.-U.: Harvard University Press.

[32] Belenky, Mary F., Blythe Clinchy, Nancy Goldberger, Jill Tarule. 1986. Women's Ways of Knowing. New York: Basic Books.

[33] L'essentialisme, attribue certaines caractéristiques ou comportements à la «nature» féminine ou masculine.

Dans le cadre de notre travail, et pour raffiner nos concepts, nous avons eu à nous débattre avec des questions à propos de la force physique relative des hommes et des femmes, et des capacités requises pour remplir des emplois non traditionnels.[35] Une vue extrême de «l'égalité» soutient que les femmes et les hommes sont très peu différents, et que les femmes devraient avoir plein accès aux emplois qui nécessitent de soulever des poids. Une vue extrême de la «différence» soutient que les femmes devraient valoriser leurs points forts, tels que la rapidité et la précision, et insister sur l'égalité des salaires même lorsqu'elles accomplissent des tâches différentes. Une vue «libérale» soutient que les femmes et les hommes devraient être testés pour voir s'ils peuvent accomplir une tâche particulière et que quiconque est en mesure de l'accomplir puisse le faire.

Nous avons commencé par examiner les résultats de l'étude sur la force et avons découvert que l'homme moyen pouvait soulever un plus grand poids que 95 % des femmes, et que le Nord-Américain moyen est environ 10 % plus grand et plus lourd que la femme moyenne. Nous avons ensuite observé des femmes dans des emplois non traditionnels. Nous avons découvert qu'il est inutile de prétendre que les femmes peuvent toutes accomplir des travaux d'hommes, tels qu'ils sont actuellement conçus, parce que beaucoup d'entre elles risqueraient de se blesser. Nous avons découvert que les femmes étaient progressivement éliminées d'un emploi de manutention d'emballages qui demandait beaucoup trop d'efforts pour les personnes de petites tailles.

De même, les outils et l'équipement conçus pour l'homme moyen contribuent à rendre la femme moyenne moins efficace. Par exemple, une mécanicienne que nous avons observée, parvenait beaucoup plus facilement à serrer des boulons avec une clé différente de celle utilisée par ses collègues masculins. Si elle avait utilisé exactement les mêmes outils et méthodes, elle aurait été moins efficace et aurait risqué de se blesser. Elle aurait peut-être même été forcée à quitter son nouvel emploi.

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[34] Hessing, Melody. 1993. «Women and sustainability: Ecofeminist perspectives». Alternatives: Perspectives on society, Technology and Environment 19(1):14-21.

[35] La discussion qui suit est tirée de nos discussions avec Joan Stevenson de l'Université Queen's.

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D'un autre côté, nos observations des milieux du travail nous ont poussées à remettre en question certaines définitions de la force. Pourquoi la force est-elle définie en terme de poids à soulever plutôt qu'en terme de capacité à travailler un quart double?

La raison de cet exemple est que, même au vu et au su des critiques sexistes relatives aux capacités des femmes, nous ne pouvons insister pour affirmer que les femmes et les hommes sont mathématiquement égaux. Plutôt, nous devons nous écarter d'une technologie qui favorise le corps des hommes et leurs techniques, vers une technologie qui prend en compte la diversité humaine. Nous devons élaborer des tests de force qui permettent de faire ressortir tant les capacités des femmes que celles des hommes.[36] Nous devrons peut-être reconcevoir les emplois ou discuter avec des travailleuses pour découvrir de nouvelles façons de le faire. Nous devrons peut-être même voir si, dans le contexte économique actuel, il est préférable d'exiger des salaires égaux pour les emplois qu'occupent les hommes et les femmes que d'insister pour la reconception immédiate de tous les emplois.

Nous ne pourrons pas adopter de vues théoriques généralisées sur ces questions, mais nous devrons nous fonder sur la recherche féministe axée sur les femmes afin d'annoncer des changements.

Ainsi, alors que nous luttons pour l'équité des sexes dans les sciences et la technologie, nous devons nous concentrer sur la prise en compte appropriée de nos différences et sur le contexte social dans lequel elles se situent. Les critiques féministes des sciences et de la technologie, doivent avancer pour inclure des règles et pratiques pour la recherche féministe dans ces domaines.[37]

QU'IMPLIQUE L'ÉGALITÉ DES SEXES DANS LES SCIENCES ET LA TECHNOLOGIE POUR LE PERSONNEL ENSEIGNANT FÉMINISTE?

Étant donné que les structures du pouvoir divulguent rarement leurs secrets, les étudiantes et étudiants sont confrontés à des messages déroutants sur les femmes dans les sciences et la technologie. Les programmes qui proposent de soutenir les femmes dans les sciences et la technologie attaquent rarement aux deux principaux obstacles à l'intégration des femmes, soit les responsabilités familiales et l'androcentricité des sciences et de la technologie. Mon gouvernement provincial, qui publie des brochures encourageant les jeunes femmes à se lancer dans des carrières scientifiques, réduit du même coup l'aide financière accordée aux jeunes étudiantes enceintes et leur donne de un à quatre mois après la naissance de leur enfant pour retourner aux études et rembourser leur emprunt. Un ministère a récemment aboli des programmes spéciaux en éducation des sciences pour les femmes, déclarant que leur objectif avait été réalisé, alors qu'un autre en lancait de nouveaux. Une importante société de service public annonce la présence de jeunes femmes dans des emplois non traditionnels mais distribue un dépliant qui ridiculise les femmes qui demandent à avoir leurs propres toilettes.

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[36] Stevenson, Joan. 1993. «Fitting women into men's genes». Présenté à la Société royale du Canada. Montréal, juin 1993.

[37] Le contexte social de la technologie est clairement défini dans l'ouvrage d'Ursula Franklin (1990). The Real World of Technology, Toronto : CBC Enterprises. Rachelle Beauchamp, Maggie Benston, Cheris Kramarae, Maureen McNeil, Ellen Balka et beaucoup d'autres ont également écrit sur ce sujet.

Mon université a une clause d'action positive dans sa convention collective depuis 1979 et soumet fièrement un rapport annuel décrivant ses efforts en matière de recrutement.[38] Toutefois, l'augmentation dans le nombre des femmes professeures s'est stabilisée après 5 ans, sous prétexte qu'on ne trouvait aucune femme qualifiée pour la tâche dans certains départements. Seulement 16,7 % des professeurs de sciences naturelles sont des femmes[39], soit la moitié du pourcentage des techniciens et celui des étudiants dans ces départements.[40] Les obstacles structurels à l'intégration des femmes n'ont pas été touchés. En raison des difficultés à harmoniser leur travail de recherche et les responsabilités familiales, les scientifiques des universités sont encore six fois moins souvent mariées que les hommes.[41]

Les étudiantes doivent être prêtes à faire la part des choses dans toute la propagande qui existe et à attaquer les obstacles de plein front. En tant que professeures, nous devons faire en sorte que le contexte social de l'intégration des femmes dans les sciences et la technologie soit clair.[42]

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[38] La clause stipule que si une femme et un homme aux compétences égales font la demande pour un poste de professeur, la femme sera embauchée.

[39] Les sciences naturelles incluent la biologie, la chimie, les sciences de la terre, les mathématiques et la physique.

[40] Voir aussi Dagg, Anne Innis, 1990. «Women in science - Are conditions improving?» Dans Ainley, Marianne G. Despite the Odds: Essays on Canadian Women and Science. Montréal : Vehicule Press, pages 337-347.

[41] Long, J. Scott. 1992. «Measures of sex differences in scientific productivity». Social Forces 71:159-178.

Afin d'aider le développement du sens critique des étudiantes, il est important que les professeurs dissipent les nuages de gloire entourant les sciences et la technologie, qui les font ressembler à des secteurs au-dessus de l'analyse de l'humain moyen. Nous devons permettre aux étudiantes d'acquérir une certaine perspective sur l'origine de la science, son objectif et la façon dont cet objectif affecte la méthodologie des sciences et les résultats de la recherche. J'estime qu'il est faux d'essayer d'attirer des jeunes gens dans les sciences et la technologie en leur montrant une vision délavée, idéalisée et volatile d'événements merveilleux. En fait, il est tout à fait irrationnel de présenter une image si inexacte et partiale des sciences. Les étudiantes et étudiants qui croient aux contes de fées ne seront jamais de bons scientifiques.

Les expériences pratiques nous donnent la chance de mettre les étudiantes et étudiants en contact direct avec les sciences réelles. Les scientifiques recueillent toute une gamme de données qu'ils sélectionnent et raffinent pour produire des hypothèses. À notre tour, nous mettons ces hypothèses à l'épreuve dans le cadre d'expériences, qui réussissent parfois et ne réussissent pas d'autres fois, ou, plus souvent, nous produisons d'autres hypothèses. Les étudiantes et étudiants peuvent avoir l'impression fausse que les expériences des scientifiques donnent toujours la bonne réponse si les expériences présentées en classe donnent toujours le résultat escompté. Par conséquent, les étudiantes et étudiants ne constatent pas la continuité entre leurs propres activités scientifiques, telles que d'établir ce qu'ils doivent manger pour se sentir bien, et les activités portant l'étiquette officielle de scientifiques.

Une autre façon pour la pédagogie de priver les étudiantes et étudiants de leur pouvoir relativement aux sciences est de leur donner l'impression que les sciences sont un sujet trop difficile à comprendre pour les gens autres que les «super-intelligents». Valider la vision des étudiantes et étudiants fait partie intégrante de la pédagogie féministe. Il est important de prouver aux étudiantes et étudiants le lien entre les sciences et leurs propres expériences, telles faire la cuisine ou marcher.

On contribue au manque de pouvoir et à l'aliénation lorsqu'on n'explique pas clairement et entièrement les questions scientifiques. Il nous arrive, en tant que professeures et professeurs, de ne pas bien comprendre quelque chose. Ainsi, nous l'expliquons rapidement afin d'éviter les questions. D'autres fois, nous n'avons tout simplement pas le temps. Il est facile de créer une atmosphère où les étudiantes et étudiants manquent d'ardeur à poser des questions, et celles et ceux qui ont appris les sciences sont souvent particulièrement dociles. Il m'est arrivé de voir une salle remplie de détentrices et détenteurs d'un doctorat en génétique demeurer complètement silencieux après une explication des plus saugrenues d'un fameux chercheur, dans le cadre d'une réunion scientifique. Nous n'avons, ni les uns ni les autres, eu le courage de poser la question qui aurait pu révéler que nous n'avions rien compris. Le chercheur m'a plus tard avoué qu'il était resté dans le vague parce qu'il ne voulait pas que nous comprenions ce qu'il faisait, étant donné qu'il voulait breveter son procédé et gagner beaucoup d'argent. Nous sommes sortis de la réunion avec un sentiment de stupidité et le chercheur est reparti avec son prestige et son secret!

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[42] Les auteures britanniques Cockburn et Walkerdine l'expliquent particulièrement bien. Voir Cockburn, Cynthia. 1987. Two-track Training. London : Macmillan Education; Walkerdine, Valerie. 1989. Counting Girls Out. London : Virago Press.

Enfin, j'ai découvert qu'il est extrêmement important d'être explicitement féministe et d'insister sur les pièges à craindre pour les femmes dans les sciences et la technologie. Ceci est vrai même si les jeunes femmes m'assurent constamment que les obstacles que nous, «les vieilles», avons eu à surmonter n'existent plus. Certaines étudiantes m'ont avoué que mes paroles leur revenaient quelques années plus tard, alors qu'elles étaient aux prises avec des conflits familiaux-professionnels ou des employeurs sexistes. Si je n'avais pas prévu leurs expériences, elles auraient pu se blâmer, particulièrement dans le contexte actuel où l'on met l'accent sur un nombre illimité de possibilités pour les femmes.

CONCLUSION

Ma mère m'a toujours dit de ne pas aller seule dans les endroits dangereux. Si nous, au CINBIOSE, avons été en mesure de développer des méthodes sensibles pour les deux sexes et d'apporter des contributions concrètes dans le domaine de la santé au travail des femmes, c'est parce que nous avons été dans une situation où nous avons été en mesure de développer des liens entre nous-mêmes, avec d'autres femmes scientifiques par le biais de l'Institut de recherche et d'études féministes de l'UQAM et avec les travailleuses par le biais des protocoles d'entente entre l'UQAM et les centrales syndicales. Le soutien et la solidarité sont absolument essentiels, et plus particulièrement face à luttes de pouvoir.

Il est très important d'enseigner aux étudiantes la façon de développer ces liens, qui constituent d'importantes sources d'idées et de soutien. Les étudiantes, les travailleuses scientifiques et techniques, et les professeures ont besoin de lieux, où partager leurs doutes à propos de leurs propres contributions, leurs étranges nouvelles idées, leurs luttes pour le respect et leurs victoires. La GASAT offre de tels espaces et je me réjouis

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de pouvoir partager à nouveau cet espace avec vous au cours des cinq prochaines journées.

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FEMINIST FORUM REPORT

Leonie J. Rennie and Lesley Parker
Science and Mathematics Education Centre
Curtin University of Technology
GPO Box U1987
Perth Western Australia

The Feminist Forum was the first of two international panel sessions enjoyed at GASAT 7. The session was expertly chaired by Canadian Peggy Tripp-Knowles, from Lakehead University in Thunder Bay. Peggy had been one of the speakers at the first Feminist Science Forum at GASAT 6. She explained that the focus of the session was to be "how feminism has transformed, or informed, my work."

Each of the five speakers then provided a unique and fascinating account of her own life and career, documenting for us the decisions and turning-points, and interpreting or reinterpreting these in the light of feminist ideals and beliefs.

Sue Lewis, from the Faculty of Engineering, Swinburne University of Technology, Melbourne, Australia, modelled a feminist approach in the segment which she led. She began by connecting us all to the theme of the forum, giving us the opportunity to talk briefly with another person about by what feminism has meant for us, and to share some key words and phrases with the group as a whole. Words like "collaboration", "dedication", "liberation", "enlightenment", "interaction", "fairness", "nurturance", "sanity", "priority", "grounded", "quality", "empowerment", "growth" and "patience" seemed to sum up a great deal of our attempts to encapsulate what feminism has meant to us in our lives and work.

For Sue herself, the transformative influence of feminism on her work comes through collaboration (particularly through the McClintock Collective in Melbourne) through democratic processes. As a woman in the early 70's, she found it was just not possible to combine the research in science she was doing with the feminism she was reading and talking about. She found the competitive environment in science was very alienating without the frameworks and perspectives to initiate the discussions she needed at the time. Feminism has taught Sue to be critical, to keep on challenging accepted ways of doing things, of seeing beyond anything that is written, anything that's said, any structures the world has organised. And at times that can be stressful, but it does recognise that many of the ways we do things in society carry the cumulative biases of past ways of doing things. We need, said Sue, to look for new ways, so that other people are treated better than we were. As a veteran of several GASATs Sue spoke of the energizing effect of the GASAT conferences.

Sandra Acker was born in the United States and spent 19 years working at the University of Bristol, England before joining the Ontario Institute for Studies in Education, at The University of Toronto, Canada. Sandra prefixed her remarks with what she described as a very minimalist definition of feminism: the belief that women suffer systematic social disadvantage because of their sex and all of the actions and politics and scholarship that follow from that standpoint. Since 1970, when Sandra taught one of the early feminist courses, she has tried to make each person feel valued and involved, enjoy themselves and learn something, thus reflecting the contemporary writing on feminist pedagogy which posits a mode of teaching and learning which is less hierarchical, more collaborative, more experiential and makes women's experiences central. Although she no longer has debates about whether, as one man in that first class insisted, women should be "fragile flowers", she finds there are still many puzzles and questions to which feminist and sociological insights can contribute. For her, feminism provides a framework to comprehend what goes on around her, and she draws on it to remember that gender is a fundamental organising principle in social life, reminding us to understand any situation or trend in its social and cultural context.

Sharon Parsons, a Canadian now working at San Jose State University in California, spoke about the importance for her of feminist theory and methodology as an autobiographical process. Sharon developed the idea that the history of the feminist movement might well be a history of our own personal development. She suggested that when you reflect on what you have done, it is like a journey into feminism; you need to change your theoretical perspectives and view of what knowledge is, not merely change your techniques. Looking back with new vision and new depth is empowering in the sense that that you know you have grown. Sharon describes herself as a post-modern feminist, but is very conscious that, as feminists, we are not all the same. We differ by race, by socio-economic status, by sexual orientation, so when one person speaks, for example as a white Western academic, then that is not the voice of all women. Sharon pointed out that the dominant paradigms within the three communities of science, science education and education don't comfortably accommodate a feminist agenda. She called for action: as feminist researchers we can make a difference, but we need to examine our agendas to be sure we are not replicating, but changing, the system.

Shirley Van Hoof is a Canadian working with the Ontario Advisory Council on Disability Issues as an advocate for persons with disabilities. A medical doctor who did her training when her children were at school, her feminist attitude stemmed from her early assumption that she was supposed to be equal. Shirley attributed this to being born and raised with her older brother and his friends on a "dirt farm", in a community where there were barely the necessities of life. (Although, she reflected, some must have been more equal than others, because the females still had to make the meals after working in the fields.) The realization that things weren't equal began when her children started school, but she, as a student in medical training, soon experienced bias herself. As a user of a wheel chair because of multiple sclerosis, she cited for us some examples of differences in sensitivity to her need. Some of her examples spoke loudly of the kinds discrimination experienced by many of us. Shirley's hope was that her daughters would be able to become involved in GASAT because "that's where the future lies".

Stella Williams works in applied science at Obafemi Awolowo University in Nigeria. She expressed gratitude to her mother who ignored the custom to "marry off" her four daughters as soon as they left school, and chose instead to allow them as much post-school education as they wanted. Stella's first real challenge, as a smart, Nigerian girl in Sierra Leone, came when the boys in her undergraduate classes decided she "needed to be broken". But instead of beating her, she beat them. Along her path, Stella has been fortunate to meet good women who believed in themselves, were proud to be women, and were proud to be smart. This stood her in good stead when she chose to go to the U.S., to Alabama University, "where smart women of colour were in the wrong place". Eventually, with the help of colleagues, she was able to make some impression by helping to establish more firmly the place of women there. Stella spoke of the need to continue to learn, and to learn from those whose qualifications were not by virtue of certificates, but by virtue of experience." Women are the first teachers, the home makers, the strategists, the budgetary controllers, and, argued Stella, "they make the world go round". The ability to bond together at GASAT conferences was an important part of the learning that keeps us alive.

The diversity among the speakers was appreciated by the large audience and we all found ourselves touched by something the speakers had said. Each one of us could reflect on aspects of her own life journey, and feel a sense of growth in that reflection. Perhaps our feelings might have been summarised by Sandra, who closed her comments with these words: "Despite the diversity and disputes, there's still a tremendous dynamic. Feminism informs the questions that I ask, the answers I give in my research, my teaching, my professional activities and my personal life."

For us the forum raised again all of the issues embedded in "writing a woman's life." The American author Carolyn Heilbrun has addressed these issues with great insight in her book of that name. Our speakers in the forum brought out many of the points made by Heilbrun: "women of accomplishment…in trying honestly to deal with their past lives, have had to confront power and control" (1988, p.17). She points out that by telling their own stories, women are able to "assume power over - take control of - their own lives." We hope that the Feminist Forum will remain a continuing element of GASAT conferences in the future. The forums have a critical role to play in enabling us to tell our stories the way we want to.

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FORUM FÉMINISTE

Léonie Rennie et Lesley Parker, Australie

Le forum féministe était présidé par Peggy Tripp-Knowles,une canadienne de l'Université Lakehead à Thunder Bay. Peggy a expliqué que le thème de la séance était : «Comment le féminisme a transformé, ou informé, mon travail».

Chacune des conférencières nous ont fait le récit de leur propre vie professionnelle et personnelle, documentant pour nous leurs décisions et changements de direction et les interprétant ou les réinterprétant à la lumière des idéaux et croyances féministes.

Elles sont **Sue Lewis**, de la Faculté du génie de la Swinburne University of Technology de Melbourne, Australie; **Sandra Acker**, Institut d'études pédagogiques de l'Ontario, Toronto, Canada; **Sharon Parsons**, à la San Jose State University, Californie, E.U.; **Shirley Van Hoof**, Conseil consultatif ontarien des affaires des personnes handicapées; et **Stella Williams** de l'Obafemi Awolowo University, Nigéria.

La diversité des conférencières a été appréciée par les déléguées et les délégués et nous avons toutes été touchées à un moment ou à un autre par leurs paroles. Chacune de nous y a relevé un aspect de sa vie personnelle et a pu croître de cette découverte. Nos sentiments ont été résumés par Sandra, qui a conclu son discours avec ces quelques mots : «En dépit de la diversité et des disputes, la dynamique demeure grandiose. Le féminisme informe les questions que je pose, les réponses que je donne dans mes recherches, mon enseignement, mes activités professionnelles et ma vie personnelle».

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INTERNATIONAL PANEL

Jan Harding, U.K.

The Panel presentation was chaired by **AnnMarie Israelsson**. AnnMarie, as Information Officer at Luleå University in Sweden, devised, procured funding for, and developed, the Teknikens Hus - a purpose-built, hands-on 'house full of technology' - which she now directs.

She has kept us in touch with developments at earlier GASAT Conferences. In 1990 AnnMarie was awarded an honorary doctorate from Luleå University for her significant contributions to science and technology education through the Teknikens Hus.

AnnMarie introduced the five panellists, from Latin America, Australia, Africa, Europe and Asia:

Sylvia Chavarria, is head of Computer Science at the University of Costa Rica;

Andrea Allard, originally from Minnesota, but resident in Australia for 20 years, now works as Equal Opportunities Curriculum Coordinator in the Institute of Education, University of Melbourne. Andrea spoke from an academic background in English and Humanities;

Eunice Okeke, from a Science Education background, now heads a Women's Studies department at Nsukka University, Nigeria;

Mona Dahms, Associate Professor of Electronic Engineering at Aalbourg University, Denmark, has spent seven years teaching in Tanzania and

Jayshree Mehta, from Ahmedabad, India. Jayshree has worked for many years in science education and has established SATWAC (Science and Technology for Women and Children) which coordinates the activities of a network of women scientists. The GASAT Board has accepted Jayshree's proposal to host GASAT 8 in India.

The panellists had been asked to give some background to the issues arising from gender and science and technology in their regions and to project their vision for the future. A number of common themes emerged from their presentations.

- **Diversity**

All drew attention to the diversity of the region they represented. Although most Latin American countries share a common language they are far from being homogeneous. Each has its own culture and traditions. The Asian region contains countries as different as Japan and Bangladesh and is home to fifty per cent of the world's population.

Mona commented that we are still puzzled by differences within Europe - statistics show female participation in science and technology education in southern Europe is at a relatively high level, but we have little knowledge of women's position in employment. The apparent greater equality of participation in Eastern Europe has been shown to be illusory: women had in the past been in low status, low paid jobs and carried the double burden of home care and work. Recent changes in Eastern Europe have further penalised women, many of whom are now unemployed.

From Africa, only English-speaking countries were represented at the conference. They share common problems, many suffering from political instability and military take-overs, but are at different stages of development. Eunice saw the ability to survive at a time of crisis, is dependent on the close-knit nature of most African societies: "In Africa you really are your brother's keeper."

- **The burden of poverty in the 'developing' world**

Sylvia and Eunice both referred to debt repayments to more wealthy countries, which continue to swallow up limited revenue. Jayshree compared literacy rates: world figures give one in five men and one in three women as illiterate, but in Asia the relative figures are one in three and two in three. The developed world's comfortable way of life was jolted by her comparison of the cascades of water at Niagara with the two pots of water that, in some parts of India, a woman walks four miles each day to collect.

But things are improving. Eunice claimed that the 1985 Nairobi conference had 'ignited the fire of concern for women's education in Africa.' More school places were provided and families encouraged to enrol their daughters.

- **Changing contexts and perceptions**

Both Mona and Andrea referred to changes in contexts in Europe and Australia. Mona identified the 1980s as a time of action and intervention, while the 1990s are a time of reflection, partly enforced by the drying up of funding in a time of recession. In Denmark, ten percent of female engineers are unemployed and so some are asking 'why do we encourage girls to become engineers when there's no employment for them?' Reflection focused attention on science and technology, with an emphasis on their transformation.

Andrea has seen the 'problem' of women and science shift from women to science. She, personally, prefers to use the term 'challenge'. In a multicultural country with legislation supportive of equal opportunities, she is aware of a great inertia to change in the system. This is particularly so in higher education, which remains 'mostly white, mostly male and mostly Anglo-Celtic.' Change may come about only by infiltration and sabotage!

- **Transforming science and technology**

Jayshree was critical of a science education that abstracted from reality and presented formalised text-book knowledge. She told the story of her disillusioned little son who came home demanding: 'Don't teach me your science, teach me the science of my teacher!' The family had watched a sparrow feeding its young with worms, but his statement - a sparrow eats worms - was marked wrong because the text-book said a sparrow eats grains. Jayshree also questioned the meaning of scientific and technological literacy. Are these achieved by formal education? Who was more literate: the manager of a chemical factory, with formal science education, who discharged acid waste into a convenient stream, or the car mechanic who, without formal training, could repair any car and make replacement parts with very limited resources.

Andrea questioned why some knowledge is selected for transmission and other ignored. What values and beliefs, operating in selection, become embedded in that knowledge for presentation? She would like to see greater integration of science and humanities, of technology and art, to create more human forms of knowledge, better able to meet the needs of our world.

Mona, returning to the 'developed' world after some years, appealed to women from 'developing' countries to show the old world a new way of working with science and technology.

Jayshree reminded us that Ghandi said 'The world has enough for everyone's need, but not everyone's greed.'

- **Cultural sensitivity**

Sylvia offered hope for new ways of working from a programme in Latin America which coordinated research into oral traditions among women in a number of countries in the region. Science and technology was a dimension in this research. Personal knowledge and unique experience were valued. The principle: 'Think globally, act locally' guided action to adapt, transform and create their own solutions. In Costa Rica a Women's Studies Master's Programme was being developed, across institutions and disciplines, including science and technology.

Eunice cautioned how important it was to move slowly in Africa, where gender roles were an integral part of the cultural heritage. But there was movement. She referred to the Botswana Road Show and the Commonwealth Polytechnic Project, both of which were reported at the conference. One brave State in Nigeria had legislated against the marriage of young women before they reached the age of 18. It remains to be seen, she said, how effective this would be in supporting young women in education.

Jayshree drew attention to the anomalies which can occur if development was insensitive to cultural needs. A new textbook, distributed to 10,000 schools in India, was entitled: 'Why Johnnie Can't Add'!

- **Networking**

The experiences of a GASAT Conference were much in the minds of panellists as they made their presentations. Silvia spoke of the emotional and intellectual support she had felt. There were plans, she said, for a GASAT Latin American Chapter, with an exploratory meeting in 1994.

Eunice referred to a Commonwealth African Workshop held in early 1987 in Ghana, for which Jan Harding acted as consultant, which added science and technology to a concern for women's education. The African Region, too was planning a meeting in 1994.

Mona saw that one of the outcomes of action in the eighties had been the setting up of support networks among women in different professions.

- **Questions and Comments**

One questioner asked about programmes for deaf women. Although the panellist knew of none, both Silvia and Jayshree reported projects relating to the visually impaired.

Further information was requested on support networks. Mona referred to the Women's Group of SEFI (Societé Européan de Formation d'Ingeneurs). Jan Harding was able to add that this group had developed from the activities of Ellen van Oost, a GASAT participant from Holland.

Betsy McGregor gave information about an action and networking tool just published by the IDRC (International Development Research Council) in Ottawa (address under Betsy's name in GASAT 7 list)

Regina Papa reminded us that 80% of women were working in agriculture in the 'developing' world; they should not be forgotten, their need was great.

Kis Bonde and Margaret Bearlin reinforced the appeal for inclusion of values and ethics in science and technology. Kamala Chandrasekhar brought discussion to an end with two very apt quotations:

Louis Pasteur: 'Nature's dictionary has no such word as excuse. If you do something wrong you have to face the consequences.'

Albert Einstein: 'Science without ethics is blind; ethics without science is lame.'

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PANEL INTERNATIONAL

Jan Harding, Royaume-Unies

Le panel a été présidé par **AnnMarie Israelsson** de Lulea University, Suède. Elle a présenté les cinq panélistes.

Sylvia Chavarria est chef service des sciences informatiques de l'University of Costa Rica;

Andrea Allard, originaire du Minnesota, mais qui habite en Australie depuis 20 ans, travaille actuellement en tant que coordonnatrice du programme Equal Opportunities Curriculum de l'Institute of Education de l'University of Melbourne. Le discours d'Andrea s'est fondé sur ses antécédents académiques dans le domaine des lettres et sciences humaines;

Eunice Okeke, qui a étudié les sciences, est aujourd'hui chef d'un service d'études féminines de la Nsukka University, au Nigéria;

Mona Dahms, professeure adjointe en génie électronique à l'Aalbourg University, Danemark, a enseigné pendant sept ans en Tanzanie; et

Jayshree Mehta, demeure à Ahmedabad, Inde. Jayshree a enseigné les sciences pendant de nombreuses années et a mis sur pied le SATWAC (Science and Technology for Women and Children), qui coordonne les activités d'un réseau de travailleuses scientifiques. Le conseil de la GASAT a accepté la proposition de Jayshree de tenir la 8^e conférence GASAT en Inde.

On a demandé aux panélistes de nous parler des questions qui se posent dans leurs régions relativement à l'équité des sexes en sciences et en technologie et de leur vision de l'avenir. Un certain nombre de thèmes communs sont ressortis de ces présentations: la diversité; le fardeau de la pauvreté dans les pays «développés»; changer les contextes et les perceptions; transformer les sciences et la technologie; sensibilité culturelle; et réseautage.

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SYMPOSIUM "IF WOMEN RAN SCIENCE...."

Participants representing the Women's Studies Research Unit of the University of Saskatchewan in Saskatoon:

Inger Anderson
2429 Clarence Ave. South
Saskatoon, Sask.
Canada, S7J 1M1

Toni MacNeil
Gabriel Dumont Institute
2nd Floor
505 23rd Street East
Saskatoon, Sask.
Canada, S7K 4K7

Lillian Dyck
Women's Studies Research Unit
c/o Neuropsychiatric Research
A136MRB,
University of Saskatchewan
Saskatoon, Sask.
Canada, S7N 0W0

Jan Schmitz
1319A 11th Street East
Saskatoon, Sask.
Canada, S7H 0G4

Chair: Lillian Dyck

This symposium was originally arranged by the Women's Studies Research Unit as part of the 1992 Whelen Visiting Lecture Series of the University of Saskatchewan. Each contributor had ten minutes to address a particular aspect of women in science and the possibilities for change, when women have more control over science.

Lillian spoke first. Her topic was *Women in the workplace* which centred on the messages given by two eminent female scientists who had visited the University of Saskatchewan within the past year. Their opinions on the obligations of a woman in science seemed to be diametrically opposed both to feminist points of view as well as to those of 'ordinary' scientists such as Lillian.

Lillian then gave a 'snapshot' overview of the women in science about whom the distinguished scientists were speaking. Using the University of Saskatchewan as the example, she demonstrated clearly that technicians and not professional or faculty women were the largest group in science. She recommended that it was time we began to pay attention to the life and work experiences of female technicians.

Inger spoke to the question *If women "ran" science, would feminist methodology prevail?* Her argument centred on the statement that science must be appropriate to women if it is to be appropriate at all. She also maintained that scientists must recognize that their research topics, because they are largely community based, have social context. Her conclusion was that ethics and collaborative techniques would play a more important role if women ran science.

Toni and Jan presented a dialogue on science education entitled, ***Teaching science as if girls and women counted***. They presented some examples in which teaching science in a more gender inclusive manner might be done. Their conclusion was that science will be a healthier subject when the presence of girls and women is established beyond doubt.

Discussion was lively after the presentations. The mention of one prominent female scientist and her inability to recognize women's special problems in science, brought a flood of reminiscences from the delegates. The difficulties in using such scientists as role models were recognized.

Some discussion from the floor revolved around the term 'role model'. The term 'exemplar' was accepted by the group as more appropriate. One delegate felt that asking women scientists and women science educators to be the only ones responsible for the transformational process in science was adding further imposition to their long list of responsibilities as women scientists. An observation was made that we need to be more aware of the scientist as a person.

Further debate involved the close relationship of science with the military complex. Someone also commented that business should participate more with the academic science community, partly because rules of business tend to be much more gender equitable than those within academia. However, one delegate informed the group that the equality of women is still not considered important within the architectural community.

The 'unilingual' abilities of many exemplars were also addressed. Most people felt that exemplars should be able to speak both scientist and feminist, and that their first language should be feminist. This linguistic metaphor impressed the delegates.

The final topic introduced from the floor described a U.N. working group on the gender implications of science and technology involved in research for the U.N. conference in Beijing, Republic of China. Using the political arena to develop a critical mass for dialogue has the potential for real weight in changing strategies both in business and in government.

This symposium ended with a challenge from the panel to all participants to imagine what it might be like if women ran science and to begin the process by attempting changes to benefit women at each delegate's workplace.

RESEARCHING, REPRESENTING AND REFORMING GIRLS' SCHOOL EXPERIENCES: AN INTERNATIONAL COMPARISON OF THE DISCOURSE ON GIRLS IN SCIENCE AND TECHNOLOGY EDUCATION

Symposium contributors

Deb Hayes
Department of Mathematics and Science
ACU-Castle Hill Campus, Sydney
Australia

Monique Volman
Centre for Educational Research
University of Amsterdam
The Netherlands

Else-Marie Staberg
Department of Education
University of Umeå
Sweden

Vicky Webber
Department of Education
Stanford University
USA

Introduction

During the past fifteen to twenty years, in Australia, the Netherlands, Sweden and the USA, issues related to girls' education have become the focus of an expanding discourse in science and technology education. Although the expansion of this discourse has successfully focused attention on girls, in this symposium we wanted to critique the characteristics of this attention from a feminist perspective. We tried to show how girls have been represented or constructed in the discourse on science and technology education, by comparing the way their experiences in these subject areas have been researched and the reforms that have been proposed in our four countries.

By using the word 'discourse' we refer to the idea that concepts, theories, research questions and methods, are social constructions, and that research does not *just* reflect reality. Analysing the policy and research discourses on girls in science and technology education may be a complementary strategy to the work of GASAT in recent years. We think that this approach helps us to reflect on the way policy-makers, teachers and researchers (including ourselves) talk about girls and their experiences in mathematics, physics, information technology etc. It is a way to show that focusing on girls as 'the problem' is not self-evident, but rather the outcome of a process in which the issue of gender, science and technology is defined. By showing how different contexts produce different discourses, an international perspective contributes to calling into question ideas and approaches that are taken for granted in our own countries and assists us to become aware of some of the limitations of our separate national perspectives. Where our analysis reveals similarities in the discourses on girls in science and technology education, this may contribute towards enhancing our efforts to foster gender equity in these areas.

In this contribution we will first give some background information on the countries in the analysis and highlight some significant issues in each country's discourse. Then we focus on the central question: how are girls constructed in the discourse of science and technology education. We conclude by indicating some dilemmas and ways forward.

Although Sweden, the Netherlands, Australia and the USA were represented in the symposium presentation, unfortunately time constraints prevented the inclusion of the American perspective in this summary.

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Background information on the countries represented

Parallel systems of vocational education and general education existed in Australia and Sweden up until the early 1960's and in the Netherlands up until 1993. This situation may partly explain the focus on educational choices in the Dutch educational policy and research. However, the existence or not of a parallel system of education may have simply determined the timing of subject choice rather than the nature of this choice, since pupils in all three countries continue to make similar 'choices' that are strongly segregated by gender and social class.

Government policy and intervention has played a role in influencing curricula. For example, equal opportunity and equal responsibility for women and men in all aspects of public and private life is an important policy in Sweden and this is reflected in the curriculum of compulsory schools (Elgqvist-Saltzman, 1992; Wernersson, 1988). In the Netherlands, the Ministry of Education and Science initiated a policy on equal opportunities for boys and girls in 1979. Likewise, in Australia the Federal Government has played an important role by providing a national forum for debate through its Commonwealth Schools' Commission which it established in 1973 to provide advise on policy related to primary and secondary schooling. The formation of this Commission may have provided the impetus for the education of girls to become an issue since prior to 1973, gender related differences in educational outcomes aroused little serious interest in Australia.

Governments have also played an important role in determining research methods and questions. For example, since the research on gender and education in the Netherlands mainly consists of research commissioned by the Government, policy objectives have been decisive in determining the questions that could be asked. In the Netherlands, little interest was initially shown in gender questions in academic educational research, and in women's studies there was not a great deal of interest in educational questions.

In Australia, the bulk of research into gender and schooling has not been carried out by academics or published within the academic literature but has taken two other forms, namely, government sponsored committees of inquiry and government funded school based research projects designed by and carried out by teachers (Yates, 1987:244-246). Unfortunately, most school based research has not been documented, or has been documented in forms which have limited accessibility, such as funding evaluation reports. Within the research reported in the academic literature, investigating gender related differences in educational outcomes has been a dominant theme.

Some examples of significant issues in each country's discourse

Research on education in Sweden focused for a long time on social class. In longitudinal studies (1960-1980) on ability and performance (marks or standardised assessment), as well as social mobility, sex was only considered to be a variable, often showing that girls get better over time compared to the norm, the boys. Even when the positivist dominance of educational research was broken by structural-Marxists, there was still little interest shown in gender. However, both research perspectives showed the connection between sex and class.

Sex roles and role theory were for a long time the dominant perspective used to explain gender differences in the Netherlands, Australia and Sweden. Although this work espoused greater equality between the sexes, consistently boys were taken to be the norm upon which girls 'deviance' was measured. The characteristics ascribed to girls were frequently couched in negative terms reflecting the attitude that girls lacked something compared to boys.

In all countries in the second half of the eighties, it became clear that gender differences in educational careers were not only a problem in terms of justice or equal opportunities, but were also a labour market and economic problem. The focus in educational research changed from the broad question, 'what role does education play in the reproduction of gender inequality' to the much narrower question, 'why do so few girls choose mathematics, physics and technical courses'.

In the Netherlands, studies on mathematics and science (mainly in general secondary education) have investigated the relations between choices, achievements and attitudes of girls on the one hand, and teacher behaviour, subject matter and teaching methods on the other hand (Kuyper & Meulenbeld, 1989; Van der Werf, 1989 and Jorg et al., 1990). An increasingly influential approach looks at school characteristics that are related to more or less successful educational careers of girls (Kristensen & Jenniskens, 1990). The Dutch research into technical education which is often linked to reform programs in vocational education and which is usually more qualitative than the research on science and mathematics has tended not to been taken seriously in educational research because no hypotheses were tested on the effects on the participation, achievements and attitudes of girls towards these courses. This is despite the many insights and teaching materials that this research had produced.

In Sweden, the Ministries of Labour and Education and the National Board of Schools, conducted campaigns aimed at encouraging more girls to choose technology related subjects. In response to these campaigns, lots of small projects directed at girls occurred resulting in a temporary increase in female participation in technological education.

Some examples of how girls have been constructed

The Dutch, Swedish and Australian discourses appear to share a common construction of girls as 'the problem'. It is girls' attitudes, achievements, choices and more recently their learning styles that are different and problematic. In the Netherlands for example, early feminist questions like, 'Why is so much importance attached to maths, science and technology and so little to subjects such as home economics and languages?' have disappeared. More recent questions arising from women's studies about the role of gender in the construction of mathematics, science and technology, are not being posed in educational research.

The disappointing results of recent research in the Netherlands (hardly any educational characteristics were found that are related to girls' educational careers) provoke the conclusion that schools do not really make a difference, and thus underscores the definition of girls as the problem. How issues have been investigated may be partly responsible for the lack of results. Recent research on gender and mathematics and science does not look at mechanisms in schools that contribute to the reproduction of gender inequality, but at factors in schools and at the way these are related to characteristics of the educational careers of girls. When no correlation is found, the factor is dismissed as 'irrelevant'. In this way only factors can be found on which schools differ or that result in differences between girls. Processes that take place in every school and that may be relevant for every girl remain out of sight.

The importance of how issues have been investigated is further illustrated in the Swedish literature through a quantitative study in which girls were represented as not getting marks in math for real ability but for docile behaviour (Emanuelsson & Fishbein, 1986), and an influential structuralist-Marxist qualitative study which attempted to show the reproduction of the class system in the compulsory school (Callewaert & Nilsson, 1980). Girls (who were mostly made invisible in these studies) were constructed as docile, uninteresting, not like the real pupils, the rebellious boys.

In the Australian discourse, the construction of girls as 'the problem' is more characteristic of research reported in the academic literature than in government sponsored reports. The latter have always emphasised the role of schools and the curriculum, and more recently have emphasised the role of sexual harassment and the construction of gender. Nevertheless, school based gender equity reform efforts have been strongly influenced by the construction of girls as the problem and have primarily attempted to change girls' choices through more informed career planning and subject choice, and raise girls' self esteem and confidence in 'non-traditional' areas of study (Kenway, 1992a).

Although during the 1980's both the academic research literature and government sponsored reports in Australia emphasised the diversity of needs and experiences of girls, during the same time period gender inclusive and girl friendly reforms, based on ideas about how women and girls think and learn, grew in acceptance. This may reflect the uneven mixture of description, celebration, advocacy, analysis and criticism that is characteristics of the Australian gender and education literature (Kenway, 1992b). Conflicting developments in a country's discourse are also illustrated in the re-emergence of biological arguments in the Swedish discourse at a time when feminist views on 'GASAT issues' are beginning to influence its Ministry of Education. The re-emergence of essentialist arguments may be fuelled by scientific research in developed countries into genes 'responsible' for certain human traits.

Dilemmas and suggested future directions

The problem of gender and education is broader than girls and science and technology. There are also boys, teachers, parents etc., and there are other subjects and processes going on in schools in which gender differences are being produced. Insights gained from women's studies may help in understanding the processes that mediate between the school factors and the student factors at which mainstream educational research on gender and science usually looks. Firstly, we could investigate how subjects (like maths and science), skills, learning styles etc., acquire and have acquired gendered meanings. How are/were these meanings produced, both historically and today, in educational practice, but also in educational theory? Secondly, helpful theories have been developed, which describe the development of gendered identities as the adoption of subject positions in different and often contradictory discourses.

We also need to listen more to girls themselves. By starting from the assumption that girls are a problem, researchers have been led into looking at them as an object. They have concentrated on explaining the 'behaviour' of girls. Approaching girls as agents, who can be asked what they think and feel, makes more sense if we want to understand why and how studying mathematics, science or technology are (in)compatible with being a girl.

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INCLUSION OF WOMEN WITH DISABILITIES IN TECHNOLOGY RESEARCH AND DEVELOPMENT

Kari Krogh
Consumer-Researcher Collaboration Coordinator
The Ontario Rehabilitation Technology Consortium
The Ontario Institute for Studies in Education

Symposium Members: Kari Krogh, Mala Nairine, Anne Abbott, Shari Lyle, Zephania Matanga, Bonnie Fitzerman, Illanna Yuditsky

Introduction:

This symposium focused on the theme of inclusion based on the experiences of women with disabilities making an effort to participate in technology research and development. Several other sessions at the conference also focused on similar themes, for example those which explored involving women from developing countries and these which facilitated discussion about research methodologies used to assess the support needs for including these women. Our presentations and discussion covered issues of access and support for persons with disabilities as well as personal stories of women with a disability.

Background:

The seven symposium participants are members of the Consumer Researcher Collaboration Committee (CRCC), a committee which consists of a majority of persons with a disability (consumers). This group supports collaboration between consumers and researchers. The CRCC has been working within The Ontario Rehabilitation Technology Consortium (ORTC), a large long-term project funded by the Ministry of Health to develop assistive technologies which will improve the quality of life of persons who will be the users of the devices.

The premise of the CRC Committee is that those people who are consumers of the research should be involved throughout the stages of research, to ensure that the results of the research are useful and have an impact on the lives of consumers. The roots of the group's philosophies come from both the fields of participatory research and the independent living philosophy which has developed from the independent living organizations in the community established for and by persons with a disability.

Billions of dollars are wasted on researching, developing, manufacturing and marketing assistive technologies, such as walkers, wheelchairs, or software which are never used. By involving consumers throughout the stages of research the CRCC is working to ensure that the technologies developed by the ORTC will actually have a positive impact on the lives of consumers. Persons with disabilities who live with a limitation and a desire to overcome related barriers have a valuable contribution to make when deciding on which technologies have the greatest potential and thus should be researched and developed. They also are aware of other factors which may impede their use of developed technologies such as cost of a device and government funding policies. This principle of including the consumers of research can be applied to the many fields of scientific research which ultimately have an impact on the lives of women (such as breast cancer research).

Issues:

There are many barriers that women face when they are trying to enter into the area of science and technology, whether that is as a student, a teacher, a professional or contributor. Women with disabilities deal with additional barriers - attitudinal, systemic and physical. Participants in a previously held workshop coordinated by the CRCC identified that attitudinal barriers are often the most prohibitive. The potential contributions of an individual need to be recognized and the benefit of inclusion valued. In addition to overcoming prejudice, this will require flexibility in the way we value both expertise and experience-based knowledge as well as the way we view the joint creation of knowledge. As well, restrictive and damaging messages received from society need to be addressed. Girls and women have often been "told" that is inappropriate for them to enter the science and technology stream within an educational program or career path. Some girls growing up with a disability receive the message that obtaining any education or any employment is not appropriate and should not be expected. Efforts are required to help girls with disabilities build self-esteem and to recognize their options.

Access is also a major issue for persons with disabilities. The CRCC conducted a survey of twenty persons with a disability involved in the ORTC research to ask them to identify the issues they felt were most critical to supporting their meaningful participation.

Many people stated that they needed to be informed and included in meetings with a recognition of their individual circumstances. Access needs must be met in order to allow for an equitable means to obtain information and contribute ideas. The needs most frequently identified were those related to accessible communication and transportation. Within the ORTC the CRCC has worked to educate researchers about the need for access accommodations and the costs related to access and its coordination. In addition to putting materials into accessible formats such as braille and large print, we have also had to consider things such as the amount of information conveyed and the media used to convey the information. The CRC Committee recently produced a videotape with subtitles as a medium to convey information about consumer involvement in technology research. We believed that this would reach people with various types of disabilities and also circumvent barriers experienced by people who have limited literacy skills. The level of conceptual complexity and the amount of jargon used are other issues we have had to consider when producing the CRC Connection newsletter.

Personal stories:

Anne Abbott spoke of her experience as a nonspeaking and physically disabled woman who has been asked to participate in a number of research projects over the course of her life. She spoke of how her more recent experiences have been more positive. These positive experiences were characterized by having someone who requested, valued, and used her input throughout the stages of research. One experience was in assisting Kari Krogh with a Master's Thesis research project in which she played a key role in shaping the direction and design of the research as well as the interpretation of the results. She also found her work as a member and researcher assistant of the CRC Committee to be positive. She spoke of how she had developed confidence and skills. She is now considering the possibility of obtaining a university-level education. She believes that the quality and usefulness of the research also benefitted from her more extensive inclusion.

Shari Lyle spoke of her constant struggle for full participation as a woman who uses American Sign Language as her first language. She expressed her need for sign language interpretation for face-to-face meetings and her difficulty in reading complicated documents since English is her second language. A dilemma is the cost of access, since an interpreter typically costs $35/hour. The question always arises, "Who pays?" She has found that computer mediated communications is an effective way for her to participate in decision-making. This view is shared by many members of the CRCC because their disability, whether it is related to being a respirator user, having a speech impairment or low vision, affects the nature of face-to-face interaction. Shari is a member of the CRC Steering Committee which conducts business on an ongoing basis on a computer conference in addition to the monthly face-to-face meetings.

Kari Krogh spoke of her efforts to educate others on a management committee about issues of inclusion. She related the challenges of her efforts to her experience of being one of the only women on the committee and being one of the only people raising "soft science" issues among academics, researchers and developers who were used to discussing more quantifiable facts. She has been perceived by some others as being "too emotional", while others had difficulty in understanding how she could represent disability issues when she did not have a visibly obvious disability herself.

In summary, the symposium group recognized in the discussion that women who have disabilities face additional barriers to their participation in the fields of science and technology. Several members of the group provided suggestions and offers of support to the group. Requests were made to receive future issues of the CRC Connections newsletter.

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THE USE OF ROLE MODELS IN PROGRAMMES TO INCREASE THE PARTICIPATION OF GIRLS IN MATHS AND SCIENCE

Susan M Brown, The University of Melbourne, Parkville, VIC. Australia

INTRODUCTION

In 1987 the Australian Commonwealth Schools Commission wrote a National Policy for the Education of Girls in Australian Schools. One part of it states :

"All citizens need to understand and to share in the range of decisions which determine the shape of future society and which demand a broad understanding of scientific issues and a capacity for logical analysis. It is clear that without a successful grounding in mathematics and science women will continue to be under-represented in areas where critical decisions are taken." (Commonwealth School's Commission, 1987, p47)

While it is encouraging that this is recognised at a Federal Govt level, there is still a long way to go before such policies are converted into practice. Certainly there are increased numbers of women in the workforce and we have equal employment opportunity policies in place but still we have low numbers of women in scientific and technical occupations. Thus the potential skills of women in these fields are being under-utilised. This has important productivity implications for the future skill levels of Australia in an increasingly competitive world as it does in any country where women are severely under-represented in scientific and technological fields.

For women to be able to take advantage of the job opportunities in these fields, they need to have continued with these subjects at upper secondary school. But despite Australian evidence of very similar levels of achievement in lower secondary school (Parker & Offer, 1987) girls do not continue to study maths and science in the same numbers as boys. Many things contribute to this situation, but perhaps one of the most frequently cited reasons for girls' underparticipation in maths and science is the lack of female role models.

This perception, that role models play a key part in whether or not girls study maths and science at school, influenced me to investigate the effect that 'occupational' role models (ie women scientists and engineers) can have on girls' subject choices and attitudes towards women in those fields. There is much anecdotal evidence of the success of such role models but I am aware of little rigorous research having been carried out on this topic.

In this round table session I described the study I had carried out and the participants shared their experience of the effectiveness of role models and made some comparisons with the use of mentors.

METHODOLOGY

The methodology for the study comprised a classic pre-test, treatment, post-test approach. The treatment consisted of a school visiting programme involving contact between students and female occupational role models. The students who took part in the study were approximately 15 years of age and in year 10 at secondary school.

The pre- and post-tests were in the form of questionnaires. These were used to collect data firstly, on the students' behaviour in terms of their subject choices and secondly, on student attitudes towards women in science and engineering. The first questionnaire was given out before the women role models visited the students and before subject choices had to be made, the second questionnaire was administered after the visits had taken place and students had made their crucial subject choices for the following year.

THE SAMPLE

Six schools took part in the study consisting of two independent private schools, two private Catholic schools and two Government schools. Three of them were for girls only and three were coeducational, covering a range of socioeconomic levels. There were 522 students altogether in the sample, 398 females and 124 males, with approximately the same number of students from each school type.

THE PROGRAMME

The programme involved two separate visits to each school by three different women scientists, two female engineers and the project coordinator. Two speakers were from the physical sciences, as this area of science is most traditionally 'masculine', and one speaker was from the biological sciences.

The women role models talked about their jobs : what these jobs entailed, what was enjoyable about the job and what was not, what courses the role models had done at school and university, and what other jobs could be done with the same or similar qualifications. The scientists or engineers also explained to the students their reasons for entering such fields and what, if any, were the particular challenges in being a woman in a 'non-traditional' occupation. Each of the role models was given a short leaflet : "Speakers' Notes - or hints for would-be role models", so that the instructions that the speakers received were the same.

RESEARCH QUESTIONS

The questionnaires were designed so that by analysing them and comparing the students' 'before' and 'after' responses, answers could be obtained to the following research questions :

i) Can female role models help to break down stereotyped attitudes towards mathematics, science and related careers, primarily in girls but also in boys?

ii) Is the effect of female role models on stereotyped attitudes towards mathematics, science and related careers influenced by a student's ability or confidence?

iii) Do female role models influence students' subject choices and if so, for what kind of students - for boys as well as girls; for very bright, confident students or also for more average students?

iv) Can female role models help to confirm subject choices already made?

v) Is the effect of role modelling influenced by other factors, such as the type of school the student attended; whether a student already knew a female scientist or engineer?

vi) Do role models have a 'negative' effect for some students?

vii) What other factors besides ability and confidence, and what people apart from female role models are the major influences on students' subject choices?

KEY RESULTS

It was found that the women role models appeared to have a significant impact on the students' attitudes towards science and engineering, in particular on those whose attitudes were stereotypical. They also had an influence on students' subject choices, though there were slightly conflicting results in this latter case, possibly due to confounding factors.

Perhaps the most striking results were :

- just over half the students found the role models helpful, in some way, in making their subject choices.

- 34% of all those who took part in the programme said that they were influenced by the role models to increase the amount of mathematics and/or science that they planned to study;
- according to students' responses to direct questioning, the role models influenced their behaviour, in terms of subject choice, as well as their attitudes.
- before the study, many more of the boys of highest ability had already chosen physics and/or chemistry than had the girls of highest ability.
- over the course of the study, many more higher ability girls than girls of lower ability changed their choices and enrolled in physics and/or chemistry.
- 80% of the girls who changed to taking physics found the role models helpful in making their subject choices.
- very few students who previously knew a woman scientist or engineer thought that jobs for women in these fields were unsuitable and, by the end of the programme, nearly all the students thought that engineering and science were suitable fields for women.
- by the end of the programme, many more students were able to articulate their reasons for thinking engineering and science to be appropriate for women.

Of particular interest to this study was the behaviour of the ablest girls, as it is precisely this group of capable girls and their choice of these 'non-traditional subjects' that such intervention programmes aim to influence.

CONCLUSIONS

The analysis and comparisons carried out in this study enabled all the research questions posed earlier to be answered. Thus it was found that :

i) Female role models can help to break down stereotyped attitudes towards mathematics, science and related careers in both boys and girls.

ii) They do influence students' attitudes and subject choices, more so for the very bright and confident students but also for students of more average ability and confidence levels.

iii) The role models influence the subject choices of both boys and girls.

iv) They appear to help to confirm subject choices already made.

v) The effect of role modelling is influenced by some other factors, such as whether a student already knew a female scientist or engineer, but there was not enough evidence on the whole to judge whether the type of school a student attended was an influencing factor.

vi) Any 'negative' effect of the role models was minimal.

vii) Despite the influence that role models can and do have, parents remain the single greatest influence on a students' subject choices.

Many participants in the discussion were able to share anecdotal evidence of the effect that role models had had on changing student attitudes towards maths and science and in influencing subject choices. The general experience of the group supported the findings of this study. No one present had experience of the use of role models at a tertiary level.

When role modelling versus mentoring was discussed, the point was made that mentoring required much more intensive, face to face contact with students. Mentoring therefore used the few women available in a less 'efficient' way than did role modelling, putting a greater strain on such women's limited time. However it was felt that there was a place for both, with mentoring perhaps better used at a tertiary level. The need for mentors to be women at this level was questioned. Several participants knew of effective cross-sexed mentoring once students had completed science and maths courses at secondary school and had chosen a post-secondary course in a scientific or technological field.

The group agreed that role modelling was effective and valuable in changing attitudes toward maths and science and in influencing student's subject choices. It was also agreed however that further research on the use of mixed sex role models needs to be carried out.

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VIRGINITY TESTS and ARTIFICIAL VIRGINITIES IN MODERN TURKISH MEDICINE

Bilkent University
Department of Political Sciences
and Public Administration
Bilkent, Ankara 06533
Turkey

Dilek Cingdoglu

This paper is addressing two modern medical practices: virginity surgeries and virginity tests as they are currently being practised by the medical doctors (obstetrician-gynaecologists) in modern Turkish society. The virginity of the unmarried women has had a great significance for many cultures. The taboos on the pre-marital sexual relationships contribute to this social anxiety over the hymen of women. In that respect, medicine is playing a significant role in controlling women's bodies in contemporary Turkish society. This very connection between patriarchal rules and expectations about the virginity of the bride and medicine as an institution is the focus of this paper. Thirteen in-depth interviews were conducted with the Turkish ON/GYN's in order to assess the dynamics of this relationship between patriarchy and medicine. Considering that medicine's traditional power in the Turkish society is eroding to some extend and physicians are losing their high prestige, high status, well-paid positions in contemporary Turkish society, still the strong relationship between patriarchy and medicine is evident as long as the virginity tests and surgeries exist.

Paper available from author.

GENDER STUDIES IN THIRD WORLD COUNTRIES - WHO BENEFITS?

Mona Dahms
University of Aalborg,
P.O. BOX 159, DK-9100 Aalborg, Denmark.

The presentation:

This round table session has two topics. Keywords for the two topics are: railways, gender studies, Women-in-Development projects, cultural imperialism.

The first topic is a gender study, initiated by Swedish International Development Authority (SIDA) in Dar es Salaam, Tanzania. The gender study was conducted in Tanzania and Zambia within the Tanzania Zambia Railway Authority (TAZARA) from September 1991 to March 1992. The study is described in the report "The Female Locomotive Driver - paradox or potential?"

The main aim of the study, seen from a GASAT perspective, was to formulate policies for increased female employment within the corporation. The findings are - not surprisingly - that very few women are working within the railway corporation, and the majority of them are working in stereotyped, female dominated jobs. The main barrier to female employment in technical jobs within the corporation is the lack of suitably qualified women with the proper educational background. This barrier is partly caused by an inadequate number of technical educational institutions in the countries concerned, partly by the traditionally stereotyped perceptions of female and male occupations.

With a view to increasing the number of women employed in the technical field, suggested major recommendations are:

(i) To introduce a policy of awarding extra points of merit to qualified female applicants for technical jobs until a certain target, for example 20% women, is achieved.

(ii) To encourage women with appropriate technical qualifications to apply for technical jobs by including an appropriate statement in job advertisements.

(iii) To recruit women directly from Technical Secondary Schools and Technical Colleges to the lower technical cadres and to give them on-the-job training.

Recommendations have also been made for the non-technical areas, the female dominated areas, where more than half the women are working, and for the female TAZARA staff in general.

These recommendations have not yet been implemented. It is the intention of the WID officer at SIDA that the final report, which was presented to TAZARA in November 1992, is to be discussed in a forum consisting of the TAZARA management, SIDA officers and the two consultants. The aim of such a discussion - which has not yet (July 1993) taken place - would be to recommend implementation strategies for the recommendations given in the report. As inspiration for such a meeting - if it is ever going to take place! - I would very much appreciate discussions with GASAT colleagues from Third World countries and elsewhere who can help identify effective implementation strategies.

The second topic of discussion is the relevance of gender studies to Third World women, and more generally, the relevance of GASAT issues to Third World women.

Main questions here are:

1) Does the imposition of development project - like gender studies - upon Third World institutions and governments amount to cultural imperialism? If so, is it then ethically acceptable to carry out such studies? Or is it lending a voice to women who would not otherwise have had the possibility of being heard?
2) If we do impose projects, how do we ensure that the target group, ie. the women, do in fact benefit from such project?
3) Are gender studies relevant to Third World women in general?
4) Which GASAT issues are of major relevance to the Third World? And which WID issues are?
5) And finally: How do we link GASAT issues and WID issues, in order to ensure decent living conditions for all human beings, whether in the Third or the First World and whether female or male?

The discussion:

In the session approximately 20 conference participants participated, the majority of these from Third World countries, and the discussion was good and lively.

The first part of the discussion focused on the relevance of gender studies in Third World countries and the implementation of recommendations. The conclusion here was that such studies are relevant as a starting point, to raise awareness of gender imbalances in society, even though they may have limited impact. It was also pointed

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out that it is important to perform GASAT activities in the infrastructure sectors, ie. rail transport, since lots of funds go into these sectors, even if a larger impact might be achieved in other sectors.

It was pointed out, however, that gender studies should not be undertaken just because there is money to do so; management in the corporation involved must be committed to the study, for example by signing some form of "declaration of intent" stating that they are prepared to implement the given recommendations. Also, it was pointed out by several participants that it is very important to involve the target group, ie. the women concerned, in such studies. In order to secure proper implementation of the recommendations given it was suggested that a monitoring group be formed to evaluate such implementation.

The second part of the discussion focused on the broader issue of development and cultural imperialism. One male, african participant commented that we should not let african leaders get away with continued unjust practices, like violence or discrimination against women, using the excuse that it is "cultural imperialism" if they are requested by the donor society to change such practices. This statement was supported by other Third World participants. Again in this part of the discussion it was stressed that the target group **must** participate in **all** development projects, if sustainable development is to take place. Empowerment of the target group should be the prime objective. Thus the discussion ended with concluding that power is the focal point in development, and the last word goes to Jane from Uganda:

"We, the women in the Third World must stand up and fight for our rights!"

All the best of luck in the fight! Mona

MAXIMIZING WOMEN'S POTENTIAL THROUGH A SUPPORTIVE WORK ENVIRONMENT

Marlene Gallant
Director - Human Rights, Employment Equity & Staffing
Bell Canada

Many companies have historically employed large numbers of women but have traditionally underutilized them. Slowly but surely women's representation is growing in technological, senior management and other positions still dominated by men. Corporations are awakening to the reality that failure to develop and promote women throughout the organization is counterproductive, costly and inconsistent with the merit principle we perceive to be the cornerstone of most Human Resource practices.

The wealth of experience gained through initiatives such as affirmative action has shown employers that it is inadequate to simply hire or promote females into male dominant environments and expect positive long-term results. Failure to provide a workplace which gives women the means to achieve their goals leads to high turnover, excessive staffing costs and poor morale.

Bell Canada is committed to developing an equitable work environment where all employees can achieve their full potential. In order to reach this objective, Bell has implemented several measures of particular interest to women but of benefit to all employees.

A workshop sharing Bell Canada's experiences in establishing programs and initiatives to address the issues and cultural changes needed to make women feel supported and valued was presented. Discussion focussed on benefits of, and implementation strategies for, initiatives such as Alternative Work Arrangements, Reasonable Accommodation guidelines and Workplace Harassment policies and seminars, amongst others.

A COMMITMENT TO THE FUTURE
Bridging Culture, Community and Academia

Karen Joseph
The American Indian Science and Engineering Society
University of British Columbia Chapter

A post secondary education offers intellectual, economic and social payoffs in mainstream society. Transition for a student from a rural community to a major university campus is seldom easy; this is especially true when transitions are complicated by issues of gender and culture. For First Nations students, the cost in terms of culture can be overwhelming.

Karen Joseph is currently a microbiology student at the University of British Columbia and had a special interest in immunology. Upon completion of her Bachelor of Science Ms. Joseph plans to attend medical school and to better serve her community by developing professional expertise in health care.

Health care within First Nations communities has been provided primarily by outsiders for the last century. When Ms. Joseph, a Kwakwak'awakw woman, becomes a physician she hopes to address this imbalance by establishing clinics that offer alternative approaches to healing. These approaches would combine contemporary medicine with the traditional teachings of the Medicine Wheel.

Ms. Joseph discussed her schooling experience and the impacts cross cultural tensions have had on her journey into traditional and mainstream science education.

CONSIDERATIONS FOR TEACHING SCIENCE TO ABORIGINAL STUDENTS

Madeline MacIvor
Assistant Director

First Nations House of Learning
University of British Columbia

Aboriginal Peoples are highly under-represented in science related professions and science studies at the university level. This appears to be a continuation of low enrollment and achievement among Aboriginal students in mathematics and the sciences at the secondary level. Clearly this limits the number of Aboriginal students who can gain entry to post-secondary studies in the sciences.

Ironically, it is also clear that there is a very real need for Aboriginal Peoples to gain expertise in science and technology. The resolution of land claims will result in our Peoples taking a much more direct and active part in the governance, management, development, protection and enhancement of natural resources. Similarly, self-government demands Aboriginal control in areas such as economic and resource development, health care and social services. Hence the need for the development of scientific and technological skills among the Peoples is pressing.

The continued failure of western school science to meet the educational needs of Aboriginal students, and the growing need for scientific and technological expertise in our communities suggests that the science curriculum itself be reconstructed to better address the needs of our young Peoples. As a framework for discussing this issue, the presenter will use twelve 'standards' for Aboriginal education identified by Chickasaw educator, Eber Hampton. These standards include: spirituality, service, diversity, culture, tradition, respect, history, relentlessness, vitality, conflict, place, and transformation.

Paper available from author.

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HOW WOMEN CAN BE A RESOURCE IN IMPROVING THE QUALITY OF VOCATIONAL TRAINING – IN SCHOOLS AND WORKPLACES

A Norwegian innovative intervention project, "Future Job for Women" was presented by project leader, Lillebit Nordhus, from the Norwegian Directorate of Employment. The project has developed a new model for vocational training for adults and a parallel pedagogical course for the involved teachers from vocational school/adult training center, instructors/foremen from industry and vocational consultants from the labour market authorities.

The characteristics of the vocational training model are:

- It combines vocational training and general education with self–confidence building.
- The teaching is organized mainly as a production process.
- The participants are given responsibility for their own learning and co–responsibility for the production process.
- Special emphasis is laid on creating a confident and challenging learning environment, where women's experiences, competence and values are esteemed.
- The training alternates between vocational school or adult training center and local industry.
- The local labour market authorities, the local vocational school/adult training center and local industry cooperate closely on the different phases of the programme.

The pedagogical course for the teachers, instructors/foremen and the vocational consultants is – to a large extent – based on the same learning principles as the vocational training model. The object is to qualify these three types of advisors in the new methods of guiding and in cooperating.

The vocational training model was first developed and tried out in Vestfold county from 1988–90. It has been further developed and tested in a national project at four new locations; two in the south and two in the north of Norway – from 1990 to 1992, under the National Labour Market Authorities.

The aim of the project has been:

- to strengthen women's position on the labour market and
- to develop pedagogical methods that empower the participants, encourage their creative thinking and enable them to assume ownership and responsibility of their own learning and future.

Results

About 50 women (20 - 52 years) have altogether completed the the whole training programme and final exam, which is equivalent to a common basic course in mechanics in technical school plus three months acredited apprenticeship.

2/3 of them have obtained apprenticeship or ordinary work in mechanics or have taken further education in mechanics or related trades. 1/4 have started on other kinds of education or obtained jobs in other fields.

90 women have completed the 3 months' introduction course, which was aimed at strengthening the participants' self-confidence and courage to seek new careers. Most of the 40 that did not choose mechanics, started on education in other fields.

The participants who completed the whole training programme obtained generally good remarks for their final exam. Examinators from industry remarked that the standard of technical competence was clearly above average.

50 advisors from the cooperating institutions have attended parts of the pedagogical training program. 30 have attended the whole course (1 1/2 year).

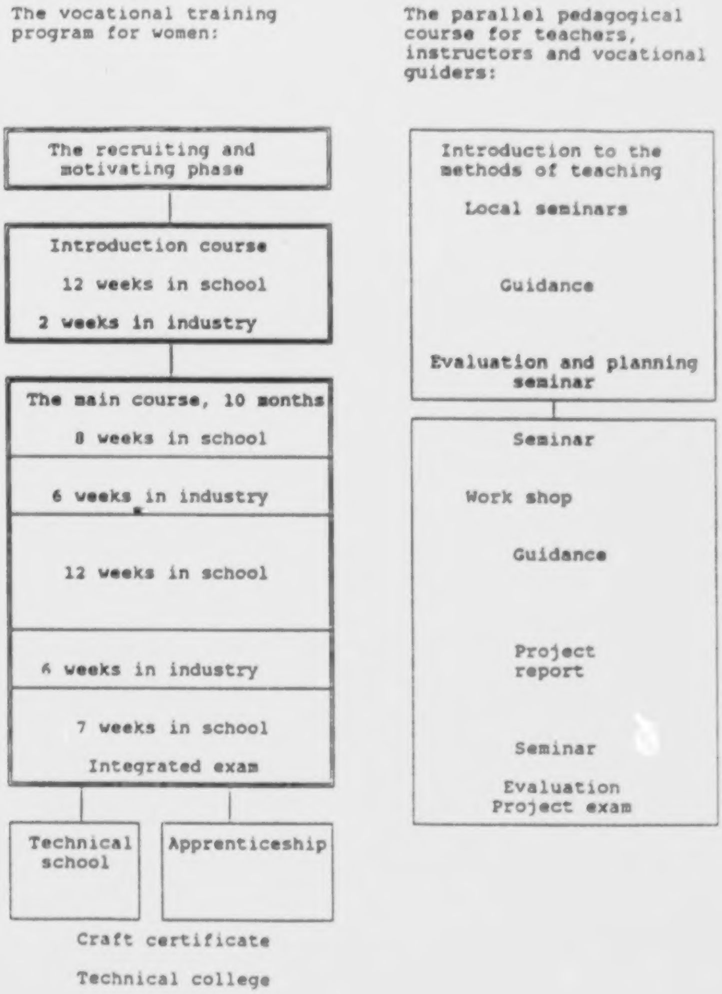
The cooperation between the local vocational school/adult training center, local industry and the local labour market authorities have to a large extent continued.

Evaluation

The material from the evaluation of the project shows:

- The pedagogics of the project have strengthened the participants' self-confidence, their awareness of their own competence and their courage to choose a new career - besides giving them good technical skills.
- The methods of teaching has in addition been educational for the teachers, both technically and personally. Even though they feel it is a demanding way of teaching, they wish to continue working with these methods, because it is more inspiring and professionally challenging.
- The feminist perspective has shown to have a positive effect on the consciousness of the participants and their advisors, even though it created much frustration in the beginning.
- The focus on women's experiences, values and competence made the advisors conscious of men's and women's different learning styles and aware of women's resources in new areas. The teachers, especially, expressed that working with women participants - in this new way - made them reconsider their attitudes, ideas and concepts. However, this was a frustrating process for many of them, most of whom were men, but also rewarding. It especially made them more aware of the importance of process for the quality of the product.
- The change from the traditional teacher/pupil roles to the roles of advisor and active participant - in the different learning environments (in school, in the workplace and in the employment agency) - have been a demanding, but inspiring process. This has made both the participants and their advisors very concious of their own roles, resourses and responsibility. The self-confidence training for the participants and the pedagogical course for the advisors have been crucial for these changes.

The vocational training model have a duration of 1 1/2 school years and has the following structure:



The parallel pedagogical course for advisors consisted of seminars, councelling and project work counting altogether 300 school hours during 1 1/2 year.

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- The cooperation between the employment service, the technical school/adult vocational training center and local industry has increased the quality of the education and training for the women. To develop the necessary cooperation has been a demanding, but educative process, both professionally and personally.
- The pedagogical course for the advisors was of utmost importance to ensure that the expected methods of teaching and guidance were used, as well as to develop the needed forms of cooperation. Practical exercises, time and methods for reflecting upon the experiences gained in the project as well as previous experiences and constructing theory have been especially important.

Futher development

The positive experience from the project "Future Job for Women" has led to a new project. The aim is to improve the training program for advisors – especially regarding the needs of the companies and the employment service. The overall intention of this is to make it a better tool for spreading the educational model all over the country and to new target groups.

The new project "Participative learning as quality assurance", is supported by the Ministry of Education, the Ministry of Labour, The Norwegian Federation of Trade Unions, the Confederation of Norwegian Indusries and the Directorate of Employment. These parties judge the educational model of vocational training and the pedagogical program for the advisors to be very interesting, both in relation to the new model for vocational training in schools and industry, which will be introduced next fall (Reform 94) and in relation to the need to strengthen and ensuring the quality of the labour market training programs.

The pedagogical programs for the advisors can contribute to creating a much needed platform for cooperation between school, industry and the employment service. It will hopefully also have a positive effect of the teaching environments within the collaborating institutions.

Discussion

The discussion was concentrated on the questions on how it is possible or if it is possible to maintain a feminist perspective when this model is tried out with other target groups.

P.S. Both my office address and my home address have changed from august/sept. 1993:

Lillebit Nordhus

Ministry of Local Government and Labour
P.O.Box 8112 Dep.
0032 OSLO, Norway
Phone: +47 22 34 47 29

Private address from 10. september 93:
Oscars gt. 82
0256 Oslo, Norway
Phone: +47 22 56 30 01

Title of Round Table: THE GLASS CEILING IN SCIENCE ACADEMIA FOR WOMEN

Presenter: PEGGY TRIPP-KNOWLES
Lakehead University
Ontario, Canada

The presentation portion of this round table summarized the historical progress of women gaining access to science academia in North America, reviewed international statistics on the present proportions of women working in science, reviewed the literature on present barriers and proposed hypotheses about strategies for overcoming barriers. This was followed by a lively discussion about these barriers and strategies.

The historical perpsective was comprised of a review of progress and strategies as presented in Margaret Rossiter's 1982 book, "Women Scientists in America" for the years 1830 - 1940. Historical information subsequent to 1940 was provided by ideas from the feminist science literature as well as personal experience.

The glass ceiling in science for women in 1830 rested on the secondary school graduation cap: Post-secondary education was unavailable until seminaries for women opened starting in the 1830's. The ceiling rose to rest on the undergraduate graduation cap when seminaries were converted to degree granting institutions and state institutions accepted women students in the 1870's. The two most successful strategies for raising the ceiling to graduate degrees in the 1890's were termed slow infiltration and coercive philanthropy. The former involved finding benevolent male patrons to approve graduate education for "special" bright women, and the latter involved offering large gifts to universities with strings attached.

The early 1900's saw very strong resistance to women's employment in science. However, by the 1920's the women's movement had reached a conspicuously spirited profile; suffragism had succeeded in gaing the vote for women and low level technical jobs as well as ghettoized science work in home economics were open to women. Madame Curie's visit in 1921 has been interpreted as detrimental to women in science because she se. an unrealisitcally high "superwoman" model. The decades from 1920 to 1940 witnessed more science degrees to women but little gains in employment options.

Retrenchment best describes the post-war era with a rise in the proportion of men in science academia and an aura of social domesticity. Feminist concern for change in science academia re-emerged in the 1960-1980 era with structural barriers being addressed such as discrimination against married women, retirement age and salary equity, formalization of tenure and promotion criteria for unbiased application. By 1980, employment equity was well established such that women were theoretically accepted in all science disciplines. From an experiential perspective, I entered science academia in 1980 in an atmosphere of security that equity was backed by legal protection. It would just be a matter of time until more women would filter into science academia. After more than a decade without marked increase in the proportion of women in science academia, this question is pertinent, "Is it just a matter of time"?

The following statistics (from Science 255:1365-1388 (1992)) were presented to illustrate the international differences in proportions of women in science academia and to emphasize the overall low proportions: (Unfortuantely, Canadian statistics were unavailable.)

Percentage of Women in Physics Faculties

Former U.S.S.R.	30
Italy	23
France	23
Belgium	11
Japan	6
United Kingdom	4
United States	3

A comprehensive literature review of contemporary research was presented next focusing on women in science academia with an emphasis on barriers, statistics, success stories and proposed strategies. The volume of literature was notable and generally located in the untraditional journal literature with recent incursions into mainstream sources. The diversity of material can be summarized as indicating that the glass ceiling for women in science academia is now firmly planted, in general, on societal attitudes and, in particular, on the attitudes of those holding scientific power, men scientists. All of science academia is theoretically inclusive but barriers are still pervasive and numerous. A synthesis from the literature indicates the following list of barriers:

1. lower job satisfaction for women with fewer women colleagues
2. more difficulty in balancing personal and professional life
3. workplace problems such as exclusion, invisibility, condescension, role stereotyping, sexual harassment, tokenism, hostility, and devaluation
4. difficulties in finding mentors and role models
5. lack of institutional empowerment

6. personal relationships disrupted by moving to advance career
7. less help from spouse
8. family responsibilities holding back career
9. limited career advancement possibilities
10. lower job security
11. lower evaluation of professional and personal success
12. lack of access to social networks in science

Two hypotheses were proposed to address the question previously mentioned, "Is it just a matter of time until we break the glass celing"? First, is the hypothesis coinciding with a commonly held belief that indeed, it is just a matter of time and patience is required. It is possible to interpret the historical record to support this claim. Second, and more likely in the opinion of the presenter, is the hypothesis that we have theoretically broken through the formal structures supporting the glass ceiling and we are now in need of new and different strategies to attack the informal attitudes and values that prop up the ceiling.

The group discussion amongst the 26 participants focused on these hypotheses. In summary, there was a general disagreement with the presenter that the formal or institutional structures supporting the glass ceiling have been effectively removed. Much work remains to be done. For example, pay equity, and retirement age equity are not well established from the experience of participants. Also, many of the listed barriers could well be addressed with institutional or political regulations such as improved day care, and hiring "quotas". The concept of inclusivity was also noted with the concern that ethnic, lesbian, and disabled minority groups in science also need attention. The session closed with a general consensus that the glass ceiling is alive and well in science academia for women and other minorities and only by increasing awareness about its existence will it be broken.

I am particularly grateful to the participants for their comments. Their ideas will contribute to the preparation of a paper on the topic to be submitted to the literature in the spring of 1994.

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"Saskatchewan Women In Engineering - Growing Strong"
Two Survey Results
Why Women Leave Engineering Survey
Women in Engineering Needs Survey

Presenter: Tami Wall, P.Eng.

Retention of Women in Engineering

Survey Responses - More often than not, Needs and Feelings
- Sense of belonging in the workplace on a personal and professional level.
- Awkwardness and frustration is felt by the women engineer, the employer and male peers.

Survey Responses - To solve the problem
- Educate, Educate, Educate
- Network, Network, Network

Initiatives -
1. Association of Professional Engineers, Education Board to develop equity and self-development courses for men and women. Develop refresher courses and re-entry programs for women in engineering.
2. Quarterly networking seminars for women engineers.
3. Mentoring program for University 4th year and graduate students to pair up with professional women.

Recruitment of Girls and Women in Science, Engineering and Technology

Survey Responses - Needs
- Would like to see more women in engineering

Survey Responses - To solve the problem
- Become more visible

Initiatives -
1. Volunteering and Funding for science camps, student day at work, science fairs, career days.
2. Memberships on science in school and related committees, gender neutral/inclusive committee.
3. Liaison with local, national and international women's groups, other professional associations.
4. Sending letters to change stereo-types to industry, retail, and engineering wives associations.
5. Other, attending and speaking at conferences, nominating women in engineering for awards.

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GENDER ACTIVITIES IN BOTSWANA

Marlies Zonneveld
University of Botswana
Private Bag 0022
Gaborone, Botswana

The University of Botswana, Faculty of Education has a Gender and Education Committee which has carried out several activities. One such activity was running a workshop for awareness of gender issues in education. A follow-up of the workshop was the production of a careers' booklet. The session included a summary of the developments of the workshop and of the booklet, including its use, determination and feedback so far.

In 1900, the Botswana Government in conjunction with the Commonwealth Secretariat, UNESCO and SIDA organised a Science and Technology Roadshow. The show was to stimulate girls to open their eyes and see that science and technology are fields for both girls and boys. The procedures, strategies of organising and managing the Roadshow will be presented.

The University of Botswana, Faculty of Science is researching and analysing strategies which motivate girls for enrollment in science courses, both at secondary schools and university levels. A proposal was discussed.

SESSION 10 - WORKSHOP - Jan Harding - *Empowering Women in Science*

This was a hands-on workshop of activities developed for, and used by, women members of the Women's Institutes (an organisation of rural women) in the UK. The aim was to break down the alienation women felt from science by having fun, relating science to everyday things with which they were familiar and encouraging them to ask questions. (A paper reporting the project was contributed to the East-West European GASAT Conference, 1992). The activities provided used portable equipment (most carried from the UK), buckets for water and a lamp.

ACTIVITIES

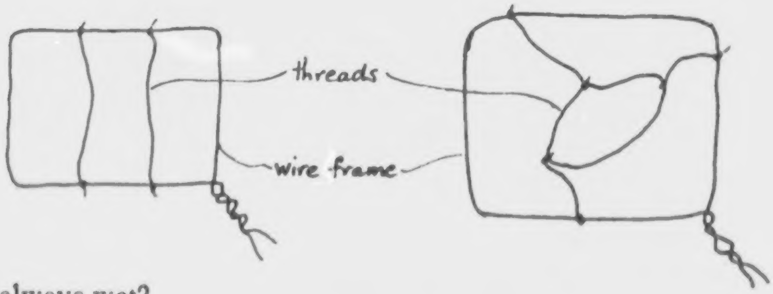
- **Water, detergents and bubbles**

Participants were asked to observe drops of water and drops of 'water plus detergent'. The latter were smaller - why?

Talc was sprinkled on water in a dish. When the centre of the surface was touched with the tip of a pencil, the talc hardly moved, but if the pencil point had a tiny drop of detergent on it the talc rushed to the sides of the dish - why? (the talc merely showed what the surface of the water was doing).

They found you can't blow bubbles with water, but you can if detergent is added.

They were asked to look at the film in a wire frame dipped in detergent solution, to break the film in one or more sections made by threads tied across and to predict what would happen to the threads.



Is water always wet?

*** Perrier bottles and paper straws.**

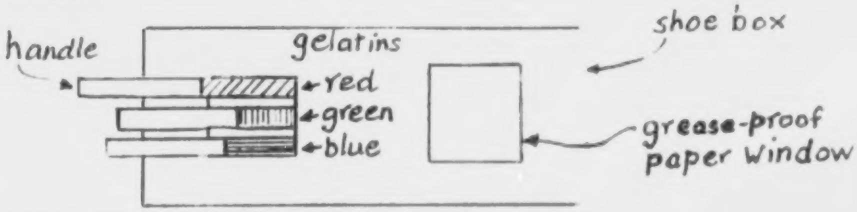
16 bottles were provided.

Participants were asked to form a scale by adjusting the amount of water in a bottle and by (a) blowing across the top and (b) tapping the side of the bottle. They found that the more water there was in the bottle the **higher** the note by blowing but the **lower** the note by tapping - why? - what is vibrating?

They were asked to cut the flattened end of a straw to a house-roof shape (Is this culturally discriminatory?) and to partially open it, so it looked like a crocodile waiting for dinner , then to put about 1 cm into the mouth without making it wet and to blow. With luck, a note sounds (waxed paper straws are better, but plastic straws don't work!). Different lengths of straw make notes of different pitch: the longer the lower. but care! blowing harder makes higher overtones.

*** A shoe box, coloured sheet gelatin and a green tissue paper elephant.**

Participants were asked to stare at the green elephant for a minute or so and then to look quickly at white flip chart paper. Most saw a fleeting pink elephant! How do we see colour? They went on to investigate with a shoe-box lined with white paper, the lid of which had a grease-proof paper window and another window covered with a strip each of red, green and blue gelatin, mounted on a card 'handle'.



We used a desk lamp to shine on to the gelatins (the torch we had was not bright enough). By varying the amount of particular gelatin over the hole we could get white light inside, magenta, cyan or yellow! We were getting colours by mixing. This is how TV pictures are made - (look at the colour on a TV screen with a magnifying glass).

- **Coloured water-soluble felt pens and white blotting paper**

Participants were asked to solve two problems:

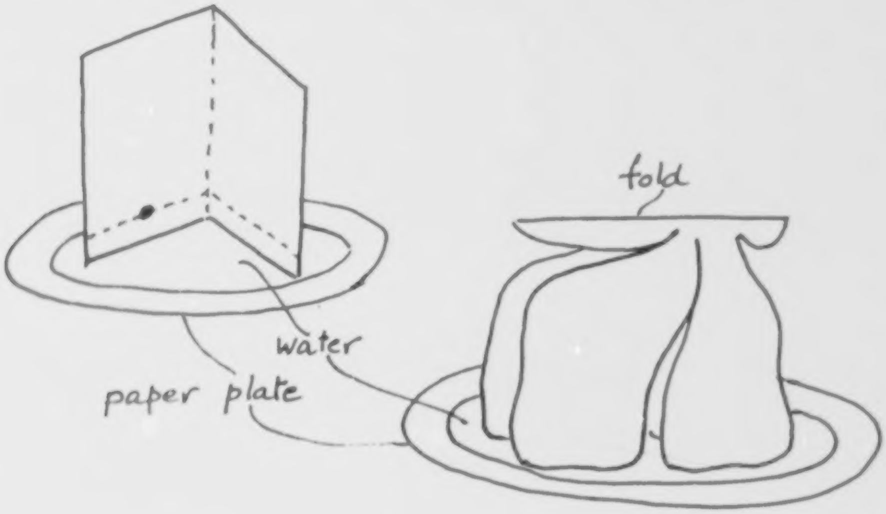
(1) which pens were used to make a given blob?

(2) are the same pigments used in two different sets of pens?

They were given rectangles of stiff blotting paper (about 10 cm by 15 cm) folded in half. These would stand, the fold opened about 90°, in a shallow dish containing a little water (a paper plate will do). The 'blob' was on a base line about 1 cm from the edge to go into the water. Pens to be compared were spotted along the base line. The base line must remain above the water. The colours (and separate pigments within them run up at different rates, but each pigment runs up at the same rate under the same conditions. Why do they run at different rates? Genetic 'finger-printing' works on this principle.

Participants were then invited to make their own chromatography butterflies.

Cut out a butterfly shape. What pens would you choose? Where would you put dots or streaks of colour?



What the presenter discovered:

- some participants looked bemused;
- some (in the know) were too eager to give the 'answers';
- it wasn't easy to get them to ask the most useful questions;
- some (even scientists) were not curious or had stopped asking why?;
- phrases like 'surface tension' were used as if they provided the complete answer, without showing understanding (is this how we teach science?);
- butterflies are more popular than problems;
- work-sheets are not enough; each activity needed a facilitator who would suggest action and prompt appropriate questions;
- too little time was left for discussion!

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AN INVITATION TO THE MEN ATTENDING GASAT 7.
INCLUDING MEN IN GENDER - INCLUSIVE SCIENCE

As men attending GASAT, we face particular questions about how we can best participate in and contribute to the conference and the work it promotes.

We know that male domination in society has led to the inequalities in science and technology, but we also want to be involved in eliminating these inequalities.

A workshop was organized for the men at GASAT 7 to share and compare our experiences and outlooks in gender and science and technology work.

The structure of the workshop was left open, to canvass all parts of view. A number of women attended specifically to provide reflection and feedback on our discussion. Other women were welcomed to attend also. The organizers of GASAT 7 were in agreement with this workshop format.

Further background reading to the purposes and organization of the workshop can be found on pages 930 of the "Contributions". All men at GASAT 7 (including non-contributing spouses*) were invited to attend the workshop and contribute to the clarification of our issues and purposes as men in GASAT.

Colin Hocking

* ie. Male partners accompanying women registered at GASAT were also welcomed & encouraged to attend.

Xerox Poster Art: Defining a Feminist School/Workplace

Lynne Joslyn
Fort Street High School
Petersham, NSW 2015
Australia

ph: int + 61 2 569 4355

This paper describes a new development in the use of xerox poster art and gender equity in schools which arose from a collaboration between a science and an art teacher at Fort Street High School. Together we facilitated a feminist discussion group with female students.

Fort Street students are selected on academic performance from diverse cultural backgrounds and many reside in inner city suburbs. The school is characterised by a tradition of radical thought and questioning of authority.

In 1990, I advertised for expressions of interest in a girls' only coffee club to meet one lunchtime a week. Over twelve months elapsed before any student responded, by which time I had begun to doubt that there would ever be a place for a feminist group in a high school.

Eventually a 15 year old student enthusiastically responded to my advertisement and thus the group was started. She was a girl at risk. Her dysfunctional family no longer provided the support she needed. A destructive relationship with a considerably older man had left her with a lot of anger which she felt she couldn't resolve in the context of her immediate peer group. She felt the need for an environment in which gender issues could be discussed.

Thus Girl's Discussion Group (GDG) began as a group of two in 1991. A member of staff, Sandra Page from the Art faculty, joined us. A few students trickled in as a matter of curiosity and some stayed.

Both the student population and the staff treated GDG with suspicion and derision. Female students were reluctant to join as they assumed the group was merely a man hating session. They were quick to demonstrate their disapproval of the group to their male peers. Some of these girls also criticised those students who did attend.

Many male students resented teacher attention and resources being directed specifically to a group from which they were excluded, and claimed that GDG should start a boy's group as a matter of fairness. Some boys also teased girls who attended.

Some male staff members teased participating students. These men claimed that an all female group was sexist and unnecessary. Some even asserted that such a group was contrary to the philosophy of a coeducational school. There were criticisms that there was no boy's group. One male staff stated that it was fashionable to be interested in feminism and that GDG students were following yet another fad. Some male members of staff sought and directly confronted individual participants in GDG.

Poster art began as advertising to attract more students to GDG meetings. It subsequently evolved into a useful mechanism to bring ideas and issues to the attention of the wider school community. We identified the most visible wall in the public domain of the school, and we have maintained a changing series of posters there ever since. We defined a girls' voice and demanded that the school listen.

The posters are usually constructed using an image taken from a newspaper, magazine or book. The image is enlarged using a photocopier until it consists of a jigsaw puzzle whose pieces are the size of an A4 page. These pieces are then glued together on art paper and colour is added using crayons. The posters are completed by adding large text. Drawing skills are not necessary so that this art form is accessible to everybody.

The posters challenge gender construction. They identify sexist practice in the school and society at large. They challenge the dominant male culture and offer alternate realities. The posters tell of the depth of women's culture in the wider community. They have initiated debate about gender issues and thus have become a large part of the public intellectual life of the school. The posters have educated the school about feminist issues such as gender segregation in the work force, affirmative action, sexual harassment and violence against women.

The posters have been punchy, direct, often humorous and always big and bold. Whilst the posters address gender construction and its oppression of both sexes, boys and men have been continually challenged and affronted by our messages. Whilst no male staff member has ever demanded the removal of a poster, the tension has occasionally become palpable. Male students have defaced posters, and on occasion, posters have been stolen.

Poster making has become a form of therapy. The process involves many steps including talking an issue through, being angry, feeling helpless in the face of entrenched biases against girls, deciding to speak out, working together, focusing the issue on an image, constructing text to communicate effectively and making a statement that is read by the entire school. Using a photocopier to enlarge the poster until it is huge and then watching the school read the message are two of the most therapeutic steps for the girls.

Our feminist art grew with GDG's contribution to a school open day. Our stall selling our own feminist objects was a great success. T-shirts and tea towels screen printed by GDG with feminist slogans sold like extremely well to students, parents and members of the public. This was very validating for the group as we made a large sum of money for the school, and drew a lot of attention and interest to our activities.

GDG's activities have broadened further to after-school seminars with guest speakers. These have provided longer time periods for discussion and valuable links with women in wider society whose messages of success and progress has been heartening.

The role of the posters remains central to the functioning of the group. Only a small minority of female students attend lunchtime sessions, so the posters have been a way of communicating to all female students. Without the posters, GDG would have only reached the small minority of girls who attend the meetings. This would have been valuable on its own as there was a perceived need for a girls' only space. The posters, however, extend the message to the entire school and raise awareness amongst staff as well as educate the boys about gender issues.

Whenever we have planned an after-school seminar, a poster has been constructed to advertise the event. This has resulted in the attendance of a wider range of students. Even those students who have not attended have been seen our posters. They have thus been made aware of the seminar topic and realised that an important guest speaker took the subject seriously, and understood that there were organised groups outside the school who were interested in the topic. The posters have been instructive and have assisted in defining the school's discourse on topics such as harassment.

GDG has remained a small group in the school. It initially was composed of 15 and 16 year olds who remained attached to the group for about 18 months. There were about 25 students at that time. At the start of the '93 school year, GDG evolved into a group of 13 and 14 year olds with a few 15, 16 and 17 year olds. Many of the former members no longer attend. The group is now defined by a new wave of enthusiastic junior students. The '93 numbers are higher than ever, with about 35 students now associated with the group.

It is understandable that only a minority of students have been attracted to the group. It is often difficult for girls to join a group which challenges male dominance. This partly supports the many studies that have shown that the greatest problem facing female students in high school is harassment from male students and members of staff. Further, at an age when female students commonly experience low self esteem and a lack of self confidence, but when they are also blooming into beautiful young women, it is difficult to ask them to join a challenge to the construction of glamour and beauty. Whilst most girls in early adolescence are socialised into winning male approval, asking them to join the challenge to boys' behaviour is a big task.

Girls are bombarded with glamorous images of women in the media which construct a narrow band of female career options. Asking girls to question this attractive type casting and investigate other options in the male domain is also difficult.

Despite our small student numbers, we are convinced that the activities of GDG, particularly our postering, have a big impact on our student community and reach out to many more students than those who attend weekly sessions or occasional seminars. Students need not publicly declare an interest in gender issues to have learned something about gender from our xerox posters.

BECOMING ADEPT AND COMFORTABLE WITH SCIENCE AND TECHNOLOGY CURRICULA

Workshop led by

Barb Leek, Canada

Workshop members were offered a hands-on experience of the sort of programme which Barb offers to schools in a rural area of Ontario. From the very beginning her students were with us - sometimes in mixed groups, sometimes female only -through the photographs the walls and even on T-shirts! This was an example of the way in which every aspect of the setting, the people, the task was consciously used to communicate a message and stimulate reflection. It was the detailed preparation and careful setting up of the materials and tools which provided a sound but unobtrusive framework, within which our group could tackle the practical tasks with confidence and experience success.

The main messages which we picked up directly or indirectly were to do with:

- love of materials, the 'feel' of wood and metal;
- respect for tools, the satisfaction of handling them well, the need to observe safety rules;
- the importance of people, the giving and receiving of support, the pleasure of social interaction.

What did we take away with us?

- something which we had made ourselves (albeit with a lot of help and advance preparation from the team), the satisfaction of concentrating on practical skills.
- Intrigue at finding that we could indeed do something which several of us had not often tried.
- Insight into the way fellow participants and members of the resource team functioned.

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Just like school students we quizzed the volunteer, a retired woman, who was helping us. What was she doing there? What did she do before? How had she got involved? Why? It was amazing how many subtle messages she communicated to us about women and technology just by being prepared to share openly. We too opened up to each other, somehow getting through several life histories! Whenever the hands were busy on a routine task the tongues got going. It was comfortable.

What did we actually make? It was inspired of the team to think of wind chimes. There, for us to think about as each one chose, was the link between the worlds of so-called 'science' and 'technology' and 'art'. At least one of us had just visited the exhibition in Toronto on the Arts and Crafts Movement and thought that relevant.

Finally a plea to the organisers of future GASAT conferences. Is there any way to avoid programming so many interesting options together so that people who have taken vast time and trouble in setting up an activity get a reasonable number of participants to work with?

Gillian Smith

England

THE STORY OF THE ANDROID

A Workshop presented by
Bev Marshman
Michelle Tocher
Nan Brien
Mary Beam

The Story of the Android, an animated video storybook of about ten minutes duration, is a timeless fable of discovery and transformation, both of a girl and of the world she encounters. Primarily targeted at girls aged six to ten years, the long term purpose of the video is to motivate increased female participation in careers in mathematics and science. The project originated with, and has been nurtured and directed by, the Provost's Advisory Council on Academic Human Resources of the University of Waterloo working with a talented design team from Creative Premises Ltd. in Toronto. It is jointly funded by the University of Waterloo and its partners: the University of Toronto, and the Ontario Ministries of Energy and the Environment. Intended for distribution to schools in Ontario and beyond, it is available in both English and French.

The workshop invited perspectives on the effectiveness and uses of this video from the registrants and guests of the GASAT 7 conference. Reflections were sought from participants based on the guiding principles of the GASAT organization and on personal and professional philosophies. The knowledge and experience of committed teachers and researchers will be of inestimable value for the development of study guides and future materials.

Workshop: Integrating Ethics with Science

Peggy Tripp-Knowles, Ph.D., School of Forestry/Department of Biology, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1; **Kareen B. Sturgeon**, Ph.D., Biology Department, Linfield College, McMinnville, OR 97128

Part I—Case Study

A. Misty Forrest is an assistant professor of biology entering her third year of a tenure-track position at a small liberal arts college in the Pacific Northwest. One of her responsibilities is to teach a biology course for non-majors (one that meets the college general education requirement). Because the economy of the Northwest is based largely in its natural resources (e.g. agriculture, horticulture, wine-making, forestry, salmon fisheries), Misty made an effort to illustrate biological concepts and principles with examples from the local environment. A problem arose when she realized that the biological precepts that were emerging among scientists in the region were radically altering the region's social and economic structure; for example, protecting the spotted owl from extinction meant reducing timber harvests in old growth forests, the accompanying closure of many sawmills, and the demise of the rural communities dependent upon them. Whereas Misty's training as a biologist had imbued her with a deep respect for the natural world and had shaped her attitudes regarding the need for scientifically-based management of natural resources, in many cases one or both parents of her students were employed by these industries, and new management perspectives were putting them at risk of losing their jobs. "Which is more important," the students asked her, "owls or people? trees and wild salmon or jobs?"

At the same time that student interest was driving her to address ethical and other dimensions of the new scientific findings, she doubted her expertise and ability to treat these topics objectively and rigorously. Moreover, her course was the only science course these non-majors were likely to take during their college careers, and the discussions were taking time away from the course content (which was hard enough to get through in one semester anyway). Something had to give. If you were Misty, what curricular, personal and professional considerations would affect your decision whether to continue to discuss ethics in this biology course?

B. Nadine Cartwright had a dilemma. She was about to teach an introductory genetics course to second year college students and wanted to incorporate a component about ethics involving biotechnology into one of the modules near the end of the course. But she was perplexed as to how to go about doing this. More importantly, she realized, she was not even confident about whether she ought to incorporate such a topic into her course.

This was Nadine's second year in a tenure stream position at this college. Her teaching experience, however, was substantial since she had instructed genetics courses for several years at a nearby university. There, she had encountered many diligent students who worked hard to master genetic problems and memorize unfamiliar vocabulary and concepts, especially in the molecular part of the course. However, it concerned her that the students rarely evaluated the course content critically. From Nadine's perspective the discipline of genetics was on the threshold of a revolutionary change, and the possibility of genetically altering life forms using biotechnology introduced new dimensions that called for ethical debate. The textbook seemed to treat these issues simply as material for memorization and regurgitation.

She had discussed this with colleagues, one of whom dismissed her concerns with an abrupt, "Our students are too young and inexperienced to engage in a meaningful ethical discussion." Another colleague empathized with the problem but felt that the lack of an ethical framework—such as would be presented in a philosophy class—made the debate meaningless. Nevertheless, Nadine continued to be bothered by this gap in the educational experience of her students. If the integration of values with science didn't occur in the science curriculum, would it ever? In fact, wasn't it unethical to offer a biology program that did not include a requirement that students analyse the ethical implications of science and technology?

To make matters more difficult, Nadine realized that she had some doubts about her own expertise and ability to treat the topic of ethics in biotechnology objectively and rigorously. Furthermore, a course component on this topic would take time away from the content, which was hard enough to get through in one semester anyway. Something had to give. If you were Nadine, what curricular, personal, and professional considerations would affect your decision whether to incorporate a module about ethics into this biology course?

Part II—The following quotes address various curricular and pedagogical problems or consequences of integrating ethics and science. How does each of the following fit with your own experiences?

A. *"Say you want to convince your father-in-law to get involved in conservation—in rescuing biodiversity. How would you start?...Would you appeal to his intelligence or to his emotions? [E]xperience provides the raw material out of which the more conceptual dimensions are formulated. The hypothesis is that if our pedagogy is purely cognitive, our chances of motivating a change in values and behavior are nil. We can't succeed in teaching...a love of life with economic arguments and ecological reasoning alone...Facts are often irrelevant. Statistics about extinction rates compute, but they don't convert."* (Soulé, M. 1988. Mind in the biosphere; mind of the biosphere. *In* E. O. Wilson (ed.) *Biodiversity*. National Academy Press, Washington, DC, pp. 465-469.)

B. *"We are unlikely to solve environmental problems if we try to teach environmental ethics as a logical, scientific course. Given the sophistication and isolation of most scientific endeavors and the limitations of our logical processes, a course in environmental ethics needs to focus on helping students develop an ecological or community instinct...People need general, underlying principles to guide their decision making."* The authors offer ten ecological rules *"designed to encourage a community instinct that may help maintain a balanced ecosystem."* (Yambert, P. A. and C. F. Donow. 1986. Are we ready for ecological commandments? *J. Environ. Educ.* 17: 13-16.)

C. In a discussion of pedagogical problems associated with developing a beginning course in chemistry and philosophical ethics, the authors state, *"Since no one course and no one instructor will do, our suggestion is to combine forces and have two or more courses with two instructors."* They then list twelve *"irreducible minimum"* number of topics that must be covered in the chemistry component and six *"essential principles"* that *"must be touched upon and discussed, preferably by reading works of great moral philosophers"* in the ethics component. They conclude, *"Essentially, then, we believe that the fundamentals of each of the disciplines must be covered in teaching ethics in science. We reject the anecdotal approach; we do not believe that one can merely pick up writings by Rachel Carson or Barry Commoner and work out reasonable ethical positions on technical questions."* (McArthur, R. P. and W. L. Smith. 1982. Ethics in science: recombinant problems. *J. Chem. Educ.* 59: 4839-841).

The following quotes are from Shor, I. and P. Freire. 1987. *A Pedagogy for Liberation: Dialogues on Transforming Education.* Bergin & Garvey, New York. The provide some interesting theoretical perspectives that we believe are relevant to discussions on integrating ethics and science.

1. *"I think that imagination, guessing, intuition, cannot be dichotomized from critical thinking...The more we are able to improve in ourselves our sensibility, the more we will be able to know rigorously. Nevertheless, we cannot stop at the level of intuition. We have to treat the object of the intuition with rigor."* (p. 185-86).

2. *"Liberatory education is fundamentally a situation where the teacher and the students both have to be learners, both have to be cognitive subjects, in spite of being different. This for me is the first test of liberating education, for teachers and students both to be critical agents in the act of knowing."* (p. 33).

3. *"If teachers don't think in terms of phases, levels, and gradations in a long process of change, they may fall into a paralyzing trap of saying that everthing must be changed at once or it isn't worth trying to change anything at all. Looking only for big changes, teachers may lose touch with the transformative potential in any activity."* (p. 35).

4. *"What we do in the classroom is not an isolated moment separate from the 'real' world. It is entirely connected to the real world, and is the real world...(p. 25)."*

5. *"This is a great discovery, education is politics."* (p. 46).

Part III—Implementation

Assume that you have made a decision that in one or more of the science courses you teach, you are going to address ethical and societal consequences of scientific advances and technologies. Where does this material fit in your curriculum? List the pros and cons of mainstreaming the course (making it an integral part of your biology curriculum) and/or restricting it to one or more courses designed especially to deal with such issues (e.g. "Science, Technology, and Society" or "Biomedical Ethics")?

ELIMINATING BARRIERS: INCLUDING BOYS AND MEN

Colin Hocking. Australia.
Including Men in Gender-Inclusive Developments and Practices: Potentials and Dilemmas

Paul M. Nyambala. Kenya.
Towards Balanced Gender Partnership in Technical Education

This session generated a great deal of lively discussion. Participants had a variety of perspectives on the nature of GASAT's agenda and the manner in which men might participate in it. It was more or less agreed that while men probably should be invited to participate in the future, that it was essential to maintain GASAT as a forum in which women's perspectives would dominate. It was suggested that men's voices would be "muted" ones in GASAT.

The following comments provide some flavour of the session.

Participant (To Colin Hocking): You ask on page 934, "How can men assist the transformation of society without losing power?" Is this possible?

Colin: I don't think so, but it is a question that we need to discuss as men.

Paul: . . . we saw the issue not as one of power, but of the roles men and women play.

Participant: We need to distinguish between "power over others" and "power to do things in society."

A number of participants disagreed with Paul's view that the issue of power was not of central concern in Africa.

A participant asked Paul Nyambala if WITED had directed any of their initiatives at men. He replied that they had--particularly at policy makers and others in positions of authority.

Participant: It's one thing to talk to people, but another to change their opinions.

There is a need for new words. Men get angry at many of the current ones.

Participant: I don't know if men have power [over us]. Men have power over nature.

Participant: Women are not the problem. In fact, we may be the solution!

Participant: We need to stop seeing competition as situations where only one person can win.

Participant: What action can men take? Don't take action . . . listen.

Participant: The ultimate power is exerted by controlling how the world is seen--i.e., world views. All world views have been constructed by men--particularly religions--men and women need to mutually construct world views.

Participant: Equality is not enough. We also need ecological sustainability.

Participant (To Paul): Have you experienced backlash to WITED's efforts?

Paul: We need to find dignity for men in other jobs. We shouldn't raise the level of embarrassment for men and women. Western notions of "partnership/equality" is highly offensive to many men.

Colin: We also need to ask "Do men advance their careers by being involved in gender issues?"

Participant: Yes GASAT should welcome men, but we must ensure that men do not dominate the discourse. GASAT is one of the few contexts in which I can experience women setting the agenda and constructing "reality" from a female point of view.

First Nation Female Participant: Aboriginal men do not have more power. In this society they are much more likely to end up in jail!

I would not want to share child rearing with men. It's an important part of my power.

Colin: I don't want Sue (my spouse) to have all of the fun.

GENDER AND COMPUTING

Norma Dogger and Marilyn Dickson. Canada.
Developing a Women's Computer Network

Alan Durndell. UK.
Gender and Computing: Changes Over Time in Scotland

Barbara Hodgson. UK.
Gender, Computers and Group Work in Science

Intervention programs for girls with computers found attitudes towards careers in computers/using computers became increasingly negative. Optimistically the programs may "innoculate" girls from being even more negative.

Reality for business:

1. Need technically competent people
2. Need socially competent people

The social aspects of computer science are often not known by students and not taught - there is an image of those interested in computers as "hackers" and as permanently linked to the screen.

ISSUES:

1. The definition of a career in computing has changed (old focus was programming, now into areas that didn't exist before, like systems analysis.)
2. Media influences on girls and boys:
   Image: - Highly technical/male
   - No communication skills
   - Big companies, jobs not pleasant for girls or even boys
   - Comment - worse in UK than elsewhere
3. Groups at computer - sense of community learning
   - Teaching strategy to group people at computer on assumption that social learning
   - Attempt to create "right" social context for learning

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- Group vs individual vs mixed sex issue
- Just because students are in groups there is not necessarily social learning or cooperative learning.

4. Primary level of focus is on integrating computers (no longer just programming)
   - Integrating turns computer into nothing more than a tool and makes computer science invisible as a subject.
   - Also minimizes the link with girls and gender

QUESTION:

What skills are critical for teachers?

Early in the course emphasize comfort with equipment, so start students off on unfamiliar programs and make them familiar.

Try to recall the feeling of being a novice, then shift from equipment to curriculum.

Use language, visual arts, social science and work at integrating known software that is useful in those fields.

QUESTION:

What do people mean by "going into computing ?"

Define terms:

- Tell terms and meanings of reference before starting intervention, so all know where they stand
- Breaking down the barriers of predetermined male/female interaction before the start will increase the chance for success.

RECRUITING

Lionel W.F. Rudd and Georgette Mitchell. Canada.
Engineering Awareness for Grade Eight Students

Jean Surry. Canada.
Open Doors: The History, Implementation and Evaluation of a Role Modelling Program

Lionel Rudd and Georgette Mitchell showed a video about their program "Engineering Awareness for Grade 8 Students" and Jean Surry spoke about Open Doors.

The discussion did not bring forth any more information than was in the paper. The following points about programs like "Open Doors" are pervasive.

1. Constant updating of brochures, lists of speakers, etc. is required as people enter and leave the program.
2. Difficulties (due to client demand and preferences) in making even use of resources and personnel.
3. Hard to maintain a friendly and non hierarchical organizing structure (particularly when necessary to incorporate) with volunteers.

Essentially, maintaining funds, keeping up to date and being readily available to clients is hard work for a voluntary organization!

ASSESSMENT/EVALUATION

Elizabeth Hegarty-Hazel. Australia.
Gender and Assessment of Students in Physics

Gaell Hildebrand and Andrea Allard. Australia.
Transforming the Curriculum Through Changing Assessment Practices

Patricia Murphy. UK.
Equity and Assessment

Léonie J. Rennie and Lesley H. Parker. Australia.
Towards Gender-Fair Assessment in Science II: The Initial Outcomes of the Research

Many factors have an influence on students' responses (e.g., - self perceptions of experience and knowledge of the context in which assessment task is presented). Putting questions "in context" may actually be a deterrent for students whose first language is not the language of the assessment. Their performance on assessment tasks may be lower than on questions with "no context". Contextualized assessment must be supported by contextualized learning/teaching.

Remaining puzzle: Why do non-English speaking women do more poorly on contextualized assessment than NES men or English speaking women? - More research needed.

Why are we assessing? To assess the knowledge and skills that we value in society? This is a very political issue!

Assessment should be embedded in the learning/teaching process.

It is important to integrate practical components into assessment approaches, i.e., assessment of laboratory/practical work. Lack of criteria may be a problem - more research is needed. There is a need for a wide range of approaches to assess practical work. If practical performance were valued highly by society, research and innovative projects would be more likely to be funded.

Assessment debate exists within a social and political context; therefore, what are the political purposes of education and correspondingly, of assessment? This is a very complex issue, there is no "perfect" assessment; there are no obvious solutions. Views of learning must also be factored into the design of assessment.

(Time ran out - more discussion continued in small groups centered around each presenter. This was an informed, insightful, reflective session!)

SESSION 3 - WOMEN IN THE WORKPLACE: INTERNATIONAL PERSPECTIVES -

Chaired and reported by Jan Harding.

Kathy Banks. Australia. *The Intractabilty of Gender Segmentation in the Workplace in Australia.*

Kamala Chandrasekhar. India. *A Female Relevant Science and Technology.*

Sudha G. Gangal. India *Science Education and Science Careers for Indian Women from Metropolitan Cities.*

Ahbor Dolly A. Ighoroje. Nigeria. *The Brain Drain Phenomenon.*

Kamala Chandrasekhar reminded us that women's work, which was service orientated, was often designated as 'lo tec', whereas men's work, characterised by virtuosity, was 'hi tec'. But women's work is that needed for development; 'hi tec' needs to be modified for service. She gave further examples of women using technologies such as biogas and plant technologies to create wealth and jobs for others.

Sudha Gangal's survey of science colleges had shown that although girls in school were as good at science, if not better, than boys and did well in college science, they were not in senior positions and very few participated in decision-making. Women do not succeed in creating an image of an acceptable scientist. They shy away from competition and from discussion.

Ahbor (Dolly) Ighoroje examined gender aspects of the brain drain occurring in a Nigerian University in response to poor remuneration and working conditions: more men than women left for work in private companies or overseas. Her survey showed that family responsibilities were a greater factor in women's response than in men's. Few men were prepared to follow their wives overseas. Although some women showed a sense of independence many were influenced by traditional view that men made decisions for the family.

Kathy Banks drew attention to the resistance in the workplace to women's progression in non-traditional fields, apparent even in Australia where Federal and State Governments had strong policies of support for equal opportunities. There women formed 80% of part-time workers, male/female wage differential was high and women formed 70% of those on welfare. Labour arbitration, formalised earlier when stereotyped assumptions were accepted without question, militated against equality. These assumptions still abound and are institutionalised in mass media (e.g. an advertisement which implied women would take time off work when 'the sales' were on), in the judiciary (e.g. in a recent rape trial the judge commented that when women said 'no' they meant 'yes') and arguments for change were made in economic terms rather than for justice.

Discussion followed on the following issues:

Availability of Child-care: in France, where good maternity leave and comprehensive day-care for children was available, the pay differential for male:female was much smaller. In Sweden, where parental leave was available, to be taken by arrangement by either parent or by both, the possibility of *requiring* fathers to take their equal share was under discussion.

Perception of men's work and women's work: Unions were often bastions of *male* power; men claimed higher skill. An example of the Ford Motor Company in the UK was given: women stitched seat covers, men fitted them, earning more and claiming higher skill. Women were on strike for equal pay for 'work of equal value'. After a year they asked to demonstrate skill: women could fit the covers but men could not stitch them. The women achieved equal pay but were, in fact, *more* skilled. Because sewing was 'women's work' it was deskilled ('lo tech'?).

How may women develop power? Men get ahead, it was suggested, not by reading current research but the 'gossip' columns - what programmes are being set up, who are funding agents, who has most influence?

Women need to become competitive without aggression. It is possible to be a woman *and* a successful scientist. A lot of attention has focussed on *role models*, but women need *mentoring*. Mentoring may involve networking among equals or paired junior/senior relationships. Reference was made to 'The Fledgling Project' reported by Ann Walton and Gill Smith in Contributions to be discussed in Session 7.

CHALLENGING THE STATUS QUO

Sandra Acker. Canada.
Gender Equity and Computers in Context

Judy Emms. UK.
Establishing Mentoring Schemes

Sue Lewis. Australia.
Including Gender in Higher Education Science and Engineering Courses

This session developed ideas concerned with effecting change and built on the discussion from an earlier session, "Beyond Beginnings." The central theme was to look critically at the nature and success of intervention strategies. Of particular concern was the need for strategies for transforming curriculum and on teaching in male dominated higher education environments. Another concern was the growing advocacy for mentoring which raises fundamental questions about its nature, intent and the relationship of mentoring to role modelling strategies.

Points Raised

In working with male academics was there variation in their responsiveness to change and how could this be addressed?

To what extent do young female students of the 90's now resist overtly feminist attempts to support them? To address this it was thought necessary to raise consciousness first.

Should the focus be on gender focused/inclusive courses or courses which open access generally (e.g., problem-solving courses, etc).

Mentoring

It was considered important to see mentoring and role modelling as essentially different but, nevertheless, central intervention strategies. It could be used at different stages and with different amounts of both resources.

Mentoring for many women was a personal and very positive experience. Yet there was a need for guidance to help people find one or to be found by one! However, it was

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agreed mentoring had to involve men and women, but should be defined by the needs of the protegée and not disallow creativity and self-determination. There is a need to challenge and resist male models and pathways to a masculine definition of success.

TRANSFORMING OUR TEACHING

Patsy Ann Giese. USA.
Helping Teachers Maximize the Learning of Female Students

Lesley H. Parker and Léonie J. Rennie. Australia.
Towards Gender-Fair Assessment in Science I: The Process of the Research

Helene Sørensen. Denmark.
You Have to do More than Just Tell Them!

Discussion and Questions:

Patsy Anne Giese described her experiences creating and teaching a university credit course on gender equity for teachers of grades 5 - 12.

The cost of presenting this course is about $1,000 per teacher. It is funded by a U.S. Government grant for initiatives to improve teaching. Teachers enrolled were paid mileage, but not a stipend. Next session teachers will be paid a stipend. The university offers the course free to teachers for three credit hours.

There has so far been no evaluation or follow-up on teachers who completed the course. Funding has just been received for such a follow-up study.

Math and sciences teachers for grades 5 - 12 were selected. This was a good mix because these teachers need, and were interested, to know what those before and after them are doing.

Researchers created an attitude questionnaire by adapting items from existing questionnaires and creating new items for areas of their own special interest. The questionnaire has not been factor analyzed, but the author will send a copy on request.

It was suggested that the author include 4th grade teachers because that is where gender differences begin.

Lesley Parker and Léonie Rennie examined the congruence between curriculum and assessment practices in the last session as well; what's happening in curriculum development? What changes, congruency, hope are there?

The Ministry of Education is providing a limited amount of professional development to implement the change in curriculum. In their work they encountered three general types of responses to the new curriculum: resisters, buyers in (who participated in development of the curriculum) and fence sitters, those waiting to see what happens.

There was some comment on the transparency indicating that teachers are going to move toward short answer and long calculation items in assessment. Is there a bias toward short, flexible answer (no calculation) assessment and against short and long calculation items? They wanted to see a variety of assessment techniques used; therefore they would hope with the new syllabus there would be an increase in short flexible answer (no calculation) questions.

Using so many methods teachers appear to be using continuous testing. Are the results used for diagnosis [of student needs] or for accumulation of data to justify marks/grades? Is it valid to use the same instrument for these two purposes? There is a problem of conflict using the same instrument for diagnosis and for marking, unresolvable at this time.

In the new assessment, is there any opportunity for students to reflect on what is their best work, their own learning and progress? There is a structure of both order (sequence) and content imposed in the new assessment practices. Student Self-assessment would be seen as soft.

Final words: In this process of revising assessment, in spite of the diligent work of a network of people committed to gender fair assessment, there have been surprising disappointments or set backs. Two examples: 1) The cover design for a guide for teachers, "Physics in context," features a maze of interlocking gears (physics will grind you down? Chew you up?) and, 2) a new book on physics and sport in which every athlete illustrated is male.

Helene Sϕrensen described an action-oriented research to change the practice of teachers of grades one through ten. Particularly amusing was Helene's "ALOF Model of

Teaching and Learning". (A LOT OF FACTORS)

One participant noted that in similar work they have the common problem that it is difficult for teachers to give up control in the classroom to students. They found that having the researcher model the behaviour, giving the teacher a chance to observe and discuss works well. Helene responded that in the next project, they plan to give teachers the right to look as well as be looked at. Peers will observe each other and then give feedback and discuss each other's teaching.

Providing teacher training in how to give and receive criticism (positive and negative feedback) would make the peer-observation process work better. Teachers did want to change.

One participant commented that she had used video and had teachers transcribe/describe what they saw. They discovered they weren't doing what they thought they were doing. Helene responded that she had only two teachers who were good, really good at giving up control.

It can be hard to be brave enough to have someone observe your teaching, but you can start with a small action research that you carry out yourself; e.g., audio tape yourself as a prelude to having observations. Remind yourself that making mistakes is normal. None of us is perfect.

In Denmark, where teachers teach grades one to ten, they are trained to teach two subjects throughout those grades. Training is four and one-half years at a teacher's college.

We need to think about our philosophy of teaching - is teaching handing down knowledge? If not, then give some control to the students. The teacher has to give herself permission to say, "I don't know," without feeling she is losing respect. To say, "I don"t know; let's find out," is not adversarial. Even when the teacher is not taking control, there can be different roles for teacher and student.

With respect to teaching with a transmission style (controlling), it was noted that it was much easier to recognize it than to change from using that style. A teacher is doing a multitude of things. A researcher is abstracting/extracting only certain things. Researchers don't understand **all** that teachers are doing. This has led teachers to dismiss much research. That's why Helene finds it useful as a researcher to take the role of the teacher and let the teacher observe her.

In order to give control, we should be helping students learn to critique their own and their peers' work. They need this in order to get the classroom more student-centered.

Overall Summary:

This session was particularly lively, in part because presenters kept within time guidelines and also because questions followed each paper so the momentum of each topic was sustained through the discussion. It was proposed that an interest group be established to discuss action research methods in the classroom. People who were interested met at the end of the session.

WOMEN AND SCIENCE

Nessy Allen. Australia.
A Woman of the Skies: An Australian's Contribution to Atmospheric Physics

Anne Innis Dagg. Canada.
Making Biology More Humane

Anne-Marie Scholer. USA.
Educational Histories of a Selected Group of Female Academic Biologists

The three papers presented in this session were quite different--Nessy Allen presented the story of Jean Laby, an outstanding but little-known Australian physicist who claims she was not discriminated against because she was a woman. However, Nessy Allen's paper documents a number of ways in which Laby did suffer disadvantages during her career, and her work has never received the kind of recognition it deserves. Anne-Marie Scholer studied 20 women biologists, focusing on factors they identified as important in their careers and on how they cope with stress and being a female scientist.

Anne Innis Dagg examined ethical issues around the use of dissection for teaching. Women are in the majority among those who are concerned about this issue.

The discussion was free flowing, with large numbers participating, and the conversation moving back and forth from the ethical issues around dissection to the concern for constraints faced by women scientists. A variety of alternatives to dissection were suggested: physical models and kits, computer simulations, organs from slaughter houses, videos, etc. One woman noted that having to do dissection in grade nine led her to choose to study mathematics instead of science. This led to a discussion of the role of schools, parents and the culture to influence career choices. One noted that high school science was negative and boring. Do the schools portray an appropriate view or construction of science? For example, in western culture science involves killing and dissecting. This is not so in some cultures.

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In a different vein, several spoke of concerns related to an often hostile workplace environment for women scientists. Mentoring was one strategy that can help support women, although it is not necessarily helpful. Mentors can be self serving. Mentoring seems to work best when people choose their own mentor. Attempts to set up formal mentoring structures are often not successful. Some have participated in study groups that were very effective--one participant suggested that this works best if the groups are all women. Informal small groups can work, but in a large institution it is very difficult to have any impact.

There was also some discussion of the problems of identifying systemic prejudice and discrimination. When conducting studies of women in science, there is negotiation as to what actually will appear in print. Some women say they do not believe they have been discriminated against; others are very cautious about publicly revealing discrimination.

Session 5, Monday 1330-1500, "Recruiting with Video"

Erica Belling, Professional Engineers of Ontario (PEO), Canada, presented a video funded through the Woman in Engineering Advisory Committee (WEAC). The video is 9 minutes in length and was released for distribution March 1992.

The video was designed to be used with a facilitator and came with a presenter's guide. A question was raised about what might be done differently in the guide's design to make sure that it was used correctly. Erica responded that she did not work on the guide directly herself, but believed in the importance of it helping a presenter to use the tape correctly. She felt that for future projects, more attention should be placed on the "guide" aspect of any total package. She did feel that in general, her video was being used correctly although several facilitators did mention various misconceptions in presenting it.

In a response to a question about co-ed screening and if any analysis had been drawn from it, Erica responded that there has not been any analysis of that to date, but that a few boys had commented they would like to see a boy host instead of the girl host used now.

With regard to distribution, Erica stated that the video is now being distributed by the Ontario Administry of trade, outside of Ontario.

Was the lack of VCRs in schools a problem? Erica said that VCRs were available in the schools and that this was not an issue.

When asked how costs were spread out across the various elements in the video package, Erica responded that she was not involved in that aspect of the production and did not have that information.

Val Clark and Joy Teague from Australia presented their video and their study: *The Rational, Development and Evaluation of a Video to Encourage Girls to Study Computing.* The videotape used a host to present interviews with twelve computer scientists in various occupations, and a guide features an additional twelve interviews.

The videotape was approximately 28 minutes in length and was funded through several sources. Production funding of $14,500 came from the Office of the Status of Women, $5,000 from Duskin University DEET funding, with an additional $2,000 from Duskin University to print the accompanying guide.

A concern was raised that the video may be continuing the stereotype that Maths is the most important thing needed for a career in computer science, and the resulting discussion centered around how one of the video's strengths was that it showed various jobs using the computer in different ways (i.e. as a clothing design tool).

One viewer wanted to know if the actress/host was playing the same "quirky" character that she is known for through her television performances, and the answer was "yes."

While very much acting in character, the host states that "working in a scientific lab or work place is a good place for husband hunting." One viewer in the discussion group felt that this statement was demeaning to the concept of enjoying scientific research for itself, and that the host was continuing a negative stereotype. The presenters responded that the test audience saw the host as an amusing character and related to her point of view with the sense of humor that it was intended.

Session 5: Monday

TRANSFORMING THE WORKPLACE

Chair: Dr. Suzanne G. Brainard
Speakers: Dr. Hilda Ching & Sientje Mandang - Canada & Indonesia
Dr. Isabelle Deschamps; Canada
Dr. Dolly Ighoroje; Nigeria

About 20 countries were represented in the audience. The primary themes of the discussion were:

1. How to effectively implement new policies of equity and hold governments accountable.
2. How to effect change in companies, particularly management of technology.
3. Women from all countries expressed reticence in getting involved in women's organizations for fear of being labelled "feminist" or "aggressive", or other stereotypes.
4. Again from all countries, women expressed the difficulties of balancing work and family, and proposed wage family child rearing & bearing could be accommodated.
5. Need to effect change in male behaviour, particularly attitudes; need to encourage males to become advocates with other males for female professionals, scientists & engineers.

Examples of Countries:
Uganda, Botswana, Nigeria, Ghana, Ukraine,Turkey, Australia, New Zealand, Canada, USA, Indonesia, India.

CULTURE AND CAREER CHOICE: GIRLS AND SCIENCE

Tortiv Ato. Nigeria.
Factors Related to Girls' Attitudes Towards Career Interest in Science in Benue State of Nigeria

Barbara E. Simpson. USA.
Competition as a Marker for Success in Science

Jillian Spink. UK.
Tracking the Aspirations and Achievements of Able Female Students in a Discrete Urban Area

The discussion ranged over all three paper topics. Clearly in many countries, marriage suitability viewed from family and peer group perspective seriously affected choice of future career path. also, if there is no employment available anyway, why not get married and have children to achieve peer status. These views seem to be continent-wide - Europe, Africa, India, etc.

The discussion also covered competitiveness, what we meant by it, the perspective of a male teacher of a successful student apparently lacking competitiveness, how women might generate ideas freely but sometimes see these disappear into other hands, how athletics and team players (female) have more self-esteem and competitiveness, how the perception of male teachers of male attributes such as self-assertion and pushing oneself forward, can be a negative influence and cause girls to have a confidence crisis ("why don't you believe in yourself, you never push yourself forwards").

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FEMINIST PEDAGOGY

Fran Davis. Canada.
Feminist Pedagogy in the Physical Sciences: A Research Report

Jane Gilbert and Elizabeth McKinley. New Zealand.
Collaborative Research and Teacher Development: Issues for Feminists Working in Science Education

Catherine Gillbert. Canada.
An Experiment in Female Friendly Chemistry

Jayantee Naugah. Mauritius.
Developing a Feminist Perspective on Science that Recognises the Diversity of Experiences of Women, Girls and Indigenous People

All of the presentations addressed attempts to improve either science teaching or teacher development by adopting a feminist perspective. A number of strategies and approaches have been used to this end. Some of the participants felt that the term "feminist" is problematic. It would be better to use the term "good science." It was also suggested that the term "collaborative research" might be preferable to "feminist research." There are many different forms of feminism and the term is viewed differently in different cultures.

The papers suggested that using materials and examples drawn from women's lives can make science more appealing to girls and women. Some were concerned that this could serve to reproduce existing sex roles. There may be considerable resistance to introducing feminist pedagogy/gender equity into existing programs. It is important to distinguish between interventions and truly collaborative research. In the latter case, it can be very difficult to establish a truly collaborative relationship. In teacher development programs the teacher may simply take on what the researcher wants. There is the potential for teachers to be exploited under such circumstances. Power relationships must be always considered when these issues are examined.

The papers stimulated good discussion on a number of related topics.

Education and Training For The Workplace

Margaret McKinnon, Katherine H. Downey, Marcia Braundy

First Presenter: Margaret McKinnon

This paper focuses on adolescent learners, aged 15-18, and is in a secondary school context. It is on education about work which includes technical training, work experiences, and co-operative education.

There are three areas to look at:

1. occupational segregation
2. job devaluation
3. job vulnerability

These three issues continue to be faced by women in the workplace and it is important for young women to be prepared for the workplace they will enter. It is necessary for schools to address these issues. Education about work should do more than socialize to the existing situation.

Feminist pedagogy focuses on the need to learn and discuss work education reform in hope of creating change. Male and female dominated technology classes offer opportunities to focus of workplace inequities. It is important to discuss the structure of classes and acknowledge the issues around women as a minority in the class. The resulting behaviour can be name calling, ridicule and silencing. There is a need for female training about tools and an acknowledgement that tools and equipment are not appropriately sized for women.

Courses also need to examine the constraints experienced outside of school such as peer and family pressures. These are issues already experienced by many young women working parttime. The courses also need to address conventional male and female jobs, why they are considered this way and challenge these beliefs.

We need to find ways to help young women stay in male dominated courses and allow them to ask questions that are considered disruptive as well as provide opportunities for discussions with supportive women in a non threatening environment. It is important to include males in these activities. Students need to understand the collective gains of women working.

There is a need for significant reform in what we teach and how we teach it. We need to help students become empowered to make changes.

Second Presenter: Kat Downey

The purpose of this study was to hear why women enter apprenticeships, what they experiences have been and how they stay in the apprenticeships.

Apprenticeships are usually a second or subsequent job for women. They like the physical nature of the work and the tangible results. Women have been successful against a negative backdrop, harassment, low self esteem, lack of experience and a poor economy.

The trades looked at in this paper were steamfitting, refrigeration and air-conditioning and plumbing. In researching the paper 38 women were located, 9 were contacted and 3 were used for the paper. They were between their third and fifth year of apprenticeship.

In an apprenticeship the individual must find an employer to hire them and train them as an apprentice. The quality of training can vary from employer to employer. The training has a small college component but it is largely work experience training.

Women in apprenticeship do not have a distinct voice. They are usually grouped with women in technology, operations and blue collar work.

The women studied in this paper were each interviewed 4 times for 45 to 60 minutes each time. The interviews were held in their homes. The information gathered was very descriptive or narrative. The 3 women fit the typical profile described in literature; caucasian, 30ish and had worked 7 to 9 years prior to entering the apprenticeship. Their education levels exceeded the minimum grade 10 requirement. Two of the women had worked in female dominated fields while one had worked in a male dominated area. None had taken a Women In Trades and Technology (WITT) course. Two women took pre-apprenticeship courses and one had previous experience in the field.

When asked about the positives and negatives of the apprenticeships they stated the sense of accomplishment and enjoyment of their work as positives and the decreased self-confidence and isolation as the negatives. They did not experience male coworker hostility but some male supervisor hostility.

Two of the women had poor training experiences. One women was sent out to work independently after only two weeks or training while another women was assigned non-trade work which she believed was a form of harassment. The first woman approached the Ministry of Education and Training (then Ministry of Skills Development) which offered very little support. The second women went to the union for support and after they intervened she was assigned appropriate work. The third women reported that her apprenticeship training was good.

Third Presenter: Marcia Braundy

A 1988 national study found that women entering trades were well prepared if they had taken a pre-apprenticeship course. Marcia was approached by British Columbia to write a curriculum guide and resource book for WITT courses. The Canadian vocational Association then requested a paper be written on issues around implementation of these courses.

The National WITT committee has a number of subcommittees including Industrial adjustment and WITT course curriculum. The second committee identified that nationally Witt courses varied greatly in their length and curriculum make up. The committee brought together a group of experts to provide input on what should be included in this course. This group developed a DACUM (Development Of A Curriculum) chart for WITT to be used nationally.

The committee noted that there skills that are not easy to measure but necessary to the areas of trades and technology such as critical thinking, communication, and assertiveness. They also noted that it was important not to measure competence in these areas with a grade which may have a negative effect of self-esteem.

The participants in the courses come from a variety of backgrounds. The women that have the least difficulty with the transition to trades and technology work are those who previously worked in low level, traditionally female jobs. Women re-entering work or on General Welfare Assistance(GWA) need some self development before the move on.

There are certain elements that women need to make the transition into trades and technology work.

1. They need the opportunity to learn about tools and equipment in a female only environment. Men will often dominate the equipment and the purpose for women entering the class is defeated. WITT gives women the confidence in subsequent pre-trades courses to insist on using the tools and equipment.
2. WITT uses the feminist perspective of training - same treatment is not equal treatment.
3. Effective adult training techniques.
4. A mixed profile of women in the course.
5. Need for occupational fitness. The ability to push a full wheelbarrow up a plank on the worksite is a different kind of fitness to that for other types of work.
6. Industry involvement provides community commitment to the graduates.

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Questions and Discussion:

1. What gender training is provided in programs?

Marcia Braundy - WITT subcommittee looking at frontline education is developing a seminar on recruitment and retention issues including gender training. It will be specialized to the specific sector being addressed. There is also a slide/tape presentation available, "What happens to women in tradesland" (endorsed by audience member).

2. What was the three year funding received by Margaret McKinnon and her associate?

Funding is from The Social Science and Humanities Research Council of Canada and the project will follow adolescent women in work education programs and in their own experiences.

3. How do principals receive the examination of people in educational society? (Margaret McKinnon)

Mixed reception with some criticism and some support. She is looking at ways to make the research friendly in its approach.

4. 50 women trained for work in Hibernia. Would like to submit a proposal for a Health & Safety study in Hibernia. Looking for information on "right sized" tools and protective clothing. (all presenters)

A guide is available on Personal Protective Equipment for women. Funding through the Social Science and Humanities Research Council of Canada may be available for health & safety project.

5. Did women identify why the hostility received was different on each job site? (Kat Downey)

This issue was not a primary focus of the paper but perhaps the woman who had good experiences did so because she had worked 9 years with men in a male dominated environment and 3 years with that company before she apprenticed. Her foreman was also supportive. Unionized and non-unionized setting are also different. The 2 women with poor experiences worked in a union and those specific unions did not offer good training. They had also previously worked in "pink collar" environments.

6. Are jobs held traditionally by women discussed in courses? (Margaret McKinnon)

This issue is addressed in job reform courses as well as in a previous paper. Students also have experienced this through their parttime jobs. Often female adolescents see these incidences as isolated. Young women need to hear more stories so they can see the common issues.

7. Could Margaret send copies of her paper on women in clerical work?

Copies will be sent to those requesting.

8. Woman shared personal experience where confronting harassment in her workplace had a very negative effect.

Marcia Braundy - Need to pick the battles regarding silencing so as to avoid large scale activities that are negative and have a high cost personally. Positive alliances and networks can offer good support.

9. Is there specific training for the WITT teachers? (Marcia Braundy)

Most of the WITT teachers are women skilled in tools. There are some components taught by men and the female teacher offers support. There is no specific training although there are seminars offered to vocational teachers.

SESSION 7 MENTORING: SUPPORT STRATEGIES

Valerie A. Clarke
School of Psychology
Deakin University
Geelong
Victoria
Australia, 3217

Karen Levine argued convincingly that one of the major reasons for the absence of women in professional engineering was that women entering the profession felt socially isolated. To overcome this problem a program was developed in which professional women with ten or more years of experience in engineering were recruited as mentors and each matched with a protege in a similar branch of engineering and/or with similar interests and hobbies.

Four workshops were conducted:
(1) an initial session for mentors and proteges providing an overview of the scheme;
(2) an external consultant in communication facilitated the development of specific goals and objectives for mentor-protege pairs;
(3) a session for mentors in which their concerns could be aired and discussed; and
(4) a similar session for proteges.

Mentors proved to be particularly helpful in the areas of resume preparation, job interview preparation, salary negotiation, career-family balancing, timing and selection of graduate school, analysing problems at work, and the provision of encouragement to remain in the engineering profession. A guidebook for mentors and proteges was developed.

Gillian Smith and Ann Walton described a related project in which members of a professional women's service club were invited to reflect on the factors which had influenced the development and course of their professional life. This was a structured process involving:

(1) a briefing session to define the ground rules;
(2) individual private self-reflection on their personal lives;
(3) sharing of these reflections in pairs enabling one participant to act as a sounding board for the other; and
(4) recording outcomes on a findings sheet.

This proved to be a rewarding experience for all participants and a source of rich, qualitative data.

The participants in the study were surprised at the influences on their career paths, such as chance remarks. Most women identified one or more individuals who had provided support and encouragement, assisting their development of personal beliefs in self-worth. Many recognised the on-going need for support even when apparently successful in their careers.

During the discussion the group suggested that this reflective procedure would be useful in a workshop training mentors, enabling them to develop greater insights into the factors influencing their own careers and those of the other mentors.

Many of the important features of the mentor-protege relationships were clarified during the discussion. Clear distinctions were made between mentoring, counselling, guidance, and appraisal, emphasising the need to recognise the boundaries of the mentor-protege relationship. Political problems can be minimised by choosing mentors who are outside the protege's department, and often from a different organisation. By casting the mentoring programs in the guise of staff development, institutional acceptance can be greatly increased.

The common problem of recruiting was resolved in the professional engineering project by advertising within the professional network, while in the reflective study the participants were all members of a service club who were receptive to requests to devote time to a project which might assist other women in their careers.

Both projects set a definite timetable for their activities, so that participants had a clearly defined starting time and ending time, although many of the engineering mentor-protege pairs elected to continue the relationship for á second year. In the mentor program, it was defined as the responsibility of the mentor to arrange to take the initiative in arranging the time and the place of the first interview. Both participants were expected to make a regular commitment to meet at an identified meeting place.

The possibility of incompatible pairs was circumvented in the club project through the self-selection of partners among a group of women who were well-known to each other. In the engineering study guidelines were provided for the conduct of an exit interview to be used in those cases where one or both partners felt that they wished to terminate the relationship. During this interview participants were encouraged to reflect on the benefits of the relationship rather than on the reasons for its termination. Such reasons included being in a pair which did not "click", one person moving geographically, or being in a partnership which had outgrown its usefulness.

Through both the mentoring and reflective experiences participants grew in self-knowledge, skills in the analysis of problems, and an increased awareness of the opportunities and barriers in the professional environment, while the mentors also developed skills in mentoring and the habit of mentoring.

Many participants in the group left inspired to try to formally or informally participate in some type of self reflection and/or mentoring.

POST-SECONDARY STUDENTS' PERCEPTIONS

Indira Chacko. Nigeria.
Factors Influencing Undergraduates Choice of Area of Specialisation at a Nigerian University

Carol Hollenshead and Cinda-Sue Davis. USA.
Women in Mathematics and Physics: Inhibitors and Enhancers

Jean Denby Manis. USA.
Satisfaction with the Graduate Experience: Student Perceptions of the Academic Climate

B. Regina Papa. India.
Female Science Rankholders in Post-Graduate Courses and Career Choices: An Indian Experience

This session discussed papers examining post-secondary students perceptions in three countries: India, Nigeria and the United States.

In India unemployment is very high for both women and men (70%). It is impossible to create jobs for the growing population. Papa found that the women she surveyed were unemployed or underemployed. Career choices were determined largely by cultural influences, rather than by gender ideologies. For example, among lower castes larger families mean higher family income due to child labour. As well, mothers are likely to be employed in unorganized sectors which often are seasonal and offer no employee benefits.

In Nigeria the formerly buoyant economy has plummeted, with the result being high unemployment and an increasing cost of living. As in India, this has an impact on career choices. Chacko found that for women entry requirements and societal value were important contributors to decisions about education and careers.

At the University of Michigan there were surveys examining perceived problems about the environment for women. Although this has not been published, departments are ranked and this can be used to pressure the administration to take action. Although the engineering department there is nationally ranked at the top, it was near the middle in this survey. Some of the humanities ranked lower,especially concerning sexual harassment. To address the problem of encouraging good female students to continue on to graduate studies there has been an honourary group of women created. Students are invited by the dean and participate in activities such as career seminars, etc. It has been noted that lack of positive feedback is more critical for women than for men. Women may be reluctant to choose careers they cannot discuss over dinner with their friends.

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TRANSFORMING PRACTICE: FEMINIST INFLUENCES

Else-Marie Staberg. Sweden.
Feminist Critiques of Science and Technology in Engineering Educations: Challenges and Possibilities

Ken Moffatt. Canada.
The Influence of Women upon the Definition of a Scientific Knowledge Base for the Profession of Social Work

Sharon Parsons. USA.
The History of Feminist Theory as a Basis for Review of the Gender and Science Question

All of the speakers looked at broader social/organizational/structural issues concerning the practice of science and technology. The focus was on spiritual, ethical and moral issues. Reflection was seen as a way of knowing intellectually, emotionally and spiritually.

The profession of social work is either set apart from the "real" science of sociology or is perceived as an inferior sort of sociology.

Science must be integrated with other disciplines--must reflect on itself, with philosophy. If this integration could be achieved science would see women at the centre. How might science courses be integrated with feminist theory? This might be one way of trying to start reflective, critical thinking. There was concern about the potential for these kinds of courses (i.e., feminist theory for science students) to isolate students.

Reflection on practice: It is important to give people "space" to do this. We must build a "continuous dialectic" between the personal and the political in order to accomplish it. We must encourage reflective practice as an iterative process.

Reflection on feminist theory: We recognize that there are multiple subjectivities in our selves. There are contradictions and tensions in our practice and theory. Maybe they will be integrated, but maybe not. However, the process of reconsideration, self-reflection and recognizing the connectedness of knowledge is an important process.

There was some dispute concerning elevating practice (i.e., female practice) to the level of theory. We need to question all bodies of "truth," to be careful about reifying female practice or any other bodies of truth.

Transforming practice: Are these "interventions" and innovative practices worthwhile? Yes, but we need to be aware of pervasive structural barriers, and the value of individual and collective strategies for change. We must do more than "count bums on seats;" we must re-think, re-flect on, re-connect and critique our theory and practices.

CAREERS IN SCIENCE AND TECHNOLOGY

Mary R. Anderson. USA.
Career Change Women Engineers: How are They Doing?

Clara H. Greed. UK.
Women Town Planners: Staying the Course

Dorothy R. Tovell. Canada.
So What Did You Do With Your Science Degree? A Preliminary Study of Career Patterns

Career choice is still influenced by class. However, the economic situation has an impact on career choice and decisions to change careers. Proportionally fewer women are advancing in town planning. The recession seems to have fuelled a backlash. This reinforces the need to acknowledge difficulties for women and the need to inform them of other options. Networking and collaboration are important to mitigate pressures and negative experiences that women often face.

As work conditions vary, we need to be flexible in judging women's entry into and exit from science. Options to change careers do exist for older women. We need to broaden the image of women in engineering beyond that of only the young.

We must not confuse economic growth with equality for women. We should also be wary of the individualistic "pull yourself up by the bootstraps" approach. It is important to continually monitor equality. Power structures often need to be changed.

On a final note, we should not consider women who leave science to be failures, but rather view them as models of alternative avenues for women with science degrees.

SESSION 12: INFORMATION SYSTEMS IN THE WORKPLACE

Valerie A. Clarke
School of Psychology
Deakin University
Geelong, Victoria
Australia, 3217

Cecile Crutzen opened with some comments on her motivation for writing her paper. She argued that a paper is an information system, and hence an appropriate medium for discussing information systems. She welcomed the opportunity to combine her ideas of feminist theory and of computer science.

Discussion addressed the possible natures of an information system. One view is that an information system can be considered by thinking of a book cataloguing system. The person who enters the information controls the types of information which can be retrieved. However, the development of any model is narrowing the view of the real world. The hardware of a computer necessitates shifting the context of the data being entered and modifying the data to fit the requirements of the computer, then the data is retrieved, but it lacks the original context, which changes the perceptions of the data.

It was suggested the problems of the artificiality of the data created by the lack of context could be overcome through the use artificial intelligence and expert systems as more subjective data could be entered. However, Cecile questioned this, pointing out that an expert system can present problems but it is the analyst who designs the system and the (male) experts who enter the information, limiting the types of information that are entered. The hierarchy of the logic of the expert system ensures the retention of a hierarchical structure of information. Computerised systems differ from libraries. In libraries it is possible to browse following one's interests, but expert systems structure data in a certain linear way.

Taking the perspective of a social psychologist rather than that of a computer scientist, Hilary Lips suggested that we are all social psychologists. We are all members of a group. Whereas in groups there is some interest in differential power within the group, when working with a computer there is a dimension of power which is invisible. It is the power dimension which explains many of the interactions with computers.

Many users feel disempowered because they don't have the knowledge to know what is wrong or how to fix it. There is a great deal of emphasis on what the 'boys with the toys' want, rather than what the majority of computer users need. Thus many potential users do not have any ideas as to how they could use their new computers.

Although there has been considerable research using computer attitude scales, these are often constructed from the point of view of the researcher. Qualitative research is needed to find out what the users really feel and to formulate the items or categories used in quantitative research by drawing on the insights gains from qualitative research.

Some time was devoted to the effects of technology on the body and the possible prevalence of repetitive strain injury (RSI) which is more common among women than among men. In many places people are not being informed of the exercises they can do to prevent RSI.

In some managerial reports it is suggested that efficiency has decreased as a result of the introduction of computers. There have been cases where the secretary has been away and the management has not been able to access documents due to lack of knowledge of the relevant computing system. Others suggested that computers are increasing workloads. As it is possible to enter more parameters with a computer to analyse the data, projects are including many variables that would previously have been omitted, increasing the amount of data to be analysed and reported.

Several participants suggested that many people believe that women are not good at computing, but they argued that women are good at computing, they are just not interested in some of the computing tasks which are set in schools. It is fundamental that the nature of the school system be reconsidered. Computers are being pushed into the curriculum with insufficient thought to their purpose. Users need to be involved in software development.

Discussion shifted to focus on the problems of using computers as tools in the workplace. In the clerical area there is limited opportunity for professional development. Secretaries are often given a computer and three days of training and then expected to master the computer, the software, and any future upgrades. Many of these individuals blame the computer for their frustrations, rather than blaming their lack of training, or the manuals which are rarely user-friendly. In Botswana, the secretary is given minimal training for fear that she will become valuable and move elsewhere! Other secretaries do not wish to learn as they don't want their bosses to increase their workloads.

The issue of paper usage was raised. Although some participants argued that the use of computers increased paper use due to the tendency to print multiple drafts, others argued that computer access reduced paper use due to the possibility of communicating via electronic mail, and to exchange drafts and work on documents without the need for printing. In response to the latter suggestion some women felt that working on a document on a computer reinforced the hierarchical structure of the male-dominated environment and limited the possibility of browsing.

In summary, the discussion focussed on the way in which power differentials underlie many of the concerns and issues relating to the use of computers in the workplace, and the need to develop a replacement for the popular hierarchical models which underlie most computer information systems.

CAREER CHANGE WOMEN ENGINEERS IN THE WORKPLACE

DR. MARY R. ANDERSON
INDUSTRIAL AND MANAGEMENT SYSTEMS ENGINEERING
ARIZONA STATE UNIVERSITY
TEMPE, ARIZONA
U.S.A.

INTRODUCTION

In the United States many intervention programs for women in engineering were started in the late 70's and early 80's. The participants in those programs have now been in the engineering work force for several years. Program strategies and interventions have been discussed at GASAT since the first conference in 1981. At the last GASAT conference the question was raised: how are the women engineers actually faring in the workplace? Little research had been conducted to evaluate the working woman engineer on any large scale until "The Cooper Union 1989 National Survey of Women Engineers" was completed. The Survey of Women Engineers was conducted through the mail, with 4,000 surveys randomly distributed nationwide to members of the Society of Women Engineers (SWE) in April 1989. This survey, with 2077 respondents (a 52% survey return), included the demographics of the working woman engineer, a career profile, gender issues in the work place (including job satisfaction), a personal profile, and marriage and family issues. The women were asked to judge their agreement with statements by marking either "strongly agree," "somewhat agree," "somewhat disagree," or "strongly disagree."

The Cooper Union Survey was developed and conducted by The Cooper Union for the Advancement of Science and Art, New York, by Dr. Eleanor Baum, dean of the college's Albert Nerken School of Engineering, with Lynn Appelbaum, director of Public Affairs. All of the statistics from their survey used in this paper come directly from their report, "The Cooper Union 1989 National Survey of WOMEN ENGINEERS." The Cooper Union survey was used by permission on graduates of

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the Graduate Career Change Program (GCCP) in Industrial Engineering at Arizona State University (ASU). Established in 1981, this program is one of the few graduate intervention programs that is still in existence. Of particular interest is a comparison of these career change women engineers with the working women engineers surveyed by Cooper Union. In addition to the Cooper Union survey questions, the GCCP graduates were asked several questions relating to the GCCP. To help give good direction for future intervention programs, the career change women were surveyed for an evaluation of the strengths and weaknesses of their preparation for the workplace. That analysis will not be covered in this paper. The ASU response rate was 75% (41 of 55) for the career change women.

DEMOGRAPHICS OF THE WORKING WOMAN ENGINEER

In comparing the two groups of working women engineers, several characteristics should be noted. First, the national survey was limited to members of the Society of Women Engineers and the ASU survey was limited to graduates of the GCCP. Since the ASU survey was conducted 4 years after the Cooper survey, time could account for some of the differences in salary levels and ages of the participants. However it is assumed that the general working place environment has not changed much in four years and thus general comparisons are still valid. The general results of the two surveys are remarkably similar even though less than 2% of the women engineers on the national survey were identified as Industrial Engineers and all of the career change women engineers had received their Master's degree in Industrial Engineering.

A major difference between the two groups is the age factor. Of those responding to the Cooper survey, more than two thirds of the working women engineers were 35 or younger. The age range of the career change respondents was from 33 to 57. Only 15% of the career change women were 35 or younger. Nearly 44% of these women were between 40 and 45. 57% of the women in the national survey received their bachelor degree in the past 10 years. Nearly a third of the respondents of the national survey had a graduate degree in addition to an undergradute engineering degree. Only 5% held a Ph.D. All of the women in the

ASU survey had held a Bachelor's degree longer than 10 years, and, all except one, had received a master's degree in engineering in the past 10 years (an average of 8 years). The actual years from a master's ranged from 1 to 10. 2% of the career change women have a Ph.D. The one woman without a master's degree in engineering had already earned a Ph.D. in chemistry. If we could count a second career change woman who nearly has her Ph.D., the Ph.D. percentage would also be 5 for this group.

54% of the women in the national survey were married and 8% divorced. The ASU survey had very similar results with 51% married and 10% divorced. Only 36.6% of the career change women belong to some technical society other than SWE, while nearly 75% of the national survey respondents were members of other technical societies. Only 2 of the 41 careeer change women (5%) are members of SWE. 16% of the national survey women held a Professional Engineering License. One (2.5%) of the career change women does.

On the national survey 98% were U.S. citizens, while 100% of the career change women are. On the national survey, 88% were Caucasian, 5% were Asian, 2% Hispanic and 2% African American. The career change graduates on this survey are 95% Caucasian and 5% Asian.

89% of the working women in the national survey were employed full time, with 93% of those in an engineering related field. 4% were employed part time, with nearly two thirds doing so to spend more time with their children. Only 2% of these women were unable to get a suitable full time job. 80.5% of the career change women are employed full time, with 72% of those in an engineering related field. Of the 17% career change women employed part time, 50% do so to spend more time with their children. 29% (2 women) said that they were unable to get a suitable full time job.

On the national survey, the most common areas of engineering specialization chosen from an option of 35 areas were: Mechanical (9%), Management or

Business Administration (7%), Electrical or Electronics (9%), Computer Science (6%), Environmental/Sanitary (6%), Civil (5%), Aerospace (4%) and Chemical (4%). Less than 3% chose Industrial Engineering. All of the women in the career change survey specialized in Industrial Engineering.

The working woman engineer was asked to identify the principal employer category for her current position. The results were as follows: 53.5% were employed in private industry, 13.3% were employed by federal, state and local governments, and 6.8% worked in academia. 7% were employed by utilities, 11.3% were consultants, and only 2.1% were self-employed. On the other hand, of these employed careeer change women, 34.2% are in private industry, 18.4% are self-employed, 13.2% are in academia, 10.5% in utilities, and 7.9% are consultants.

Of the national survey working women, 34% had the major portion of their work related to aerospace, computers, and defense. 28% of the career change women are working in the area of computers. The survey included 25 categories to describe the major specialty area of the employer. For the general working woman engineer, 13% were involved in research and development; 9% in construction or civil engineering; and 18% in electrical, electronics or telecommunications. Of the career change women, 25.6% are with computer or computer software employers, 15.4% are in education and information services, 7.7% in utilities, 7.7% in aircraft or spacecraft, and 7.7% in electrical, electronics, or telecommunications. Only 2.6% (1 woman) is involved in research and development.

Nearly two thirds of the women engineers had been working for less than 10 years. Only 6% have been employed for 20 years or more. All of the career change women engineers have been working for 10 years or less in an engineering related job.

CONCLUSIONS

It is interesting to note that in spite of the age differences between the two samples, the difference in the academic specialization area, the obvious sample size difference, and the four year lag between samples, the results are surprisingly similar, adding creditability to the results. In some instances where the percentages obviously differ, the general characteristics of the career change women engineers would seem to be a reasonable explanation. The sample career change women engineers are older than the national survey women by about 5 years, and due to the very fact that they have taken the initiative, challenge and risk to pursue a Master's degree after several years in the workplace, makes them a special group. In addition, the technical field of study chosen for their graduate degree is different than that of their undergraduate background.

Both the national survey and the career change women engineers reported a high level of satisfaction in their engineering careers. Most of the career change women agree with most of the national survey women that their profession has met their expectations, and that it includes interesting and important work and opportunities to learn and grow. Over 80% of each group was satisfied with their salaries and over 70% of each group said that their salaries were comparable to men doing similar work. However, 47% of the national women and 60% of the career change women thought that they were not being used to their full potential. Indeed over 56% of the career change women feel that they are overqualified for their job.

There are other workplace issues that still remain for women. Nearly 67% of the national survey women felt that they had to work harder than male engineers doing comparable jobs, while 47% of the career change women felt that this was true. A third of the national women felt alone and isolated because of their gender and felt excluded from the decision-making. Among the career change women, less than 16% feel alone and isolated due to gender, however over 38% feel excluded from decsision-making. About 35% of each group believe that they would penalized professionally if they were to take a maternity-leave. More than half of the national survey women had experienced some form of harassment on the job. This was true for about 43% of the career change women.

The surveys indicated insufficient support systems for young women who express an interest in pursuing engineering careers. The national survey found that women engineers have a high level of self esteem. This was also true for the career change women engineers. Most of the women engineers thought of themselves as feminine and attractive, although 40% of the national women felt that others perceived them as less feminine because they are engineers. A smaller percent of the career change women (21%) think this is true. A large percentage of each group felt that they had always been good students, that they were leaders, and that they were confident and assertive.

At the conclusion of the Cooper Union study, Dean Eleanor Baum makes several suggestions for action plans called for by the study. The survey of the career change women engineers confirms that her suggestions are still valid.

In summary, engineering is a good career for women in the U.S. and this word needs to get out. However, there is still work that needs to be done in the workplace to make it an equitable and positive setting for all women engineers.

ACKNOWLEDGEMENTS

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IF WOMEN RAN SCIENCE...
WOULD THE CONDITIONS OF WORK CHANGE?

Lillian E. Dyck, Ph.D.
University of Saskatchewan
Saskatoon, Saskatchewan

Last September, Dr. Rosalyn Yalow, a Nobel Laureate was invited to the University of Saskatchewan as the Whelen Lecturer. The Women's Studies Research Unit of which we are all members and of which I was Co-Chair at the time, was invited to organize a Panel Discussion with Dr. Yalow on the theme of women and science. Our panel was entitled "If women ran science..." and we wish to present to you today a similar theme - but of course, without Dr. Yalow.

In March of this year, another noted female, an aeronautical engineer from England who is active in employment Equity issues, Baroness Beryl Platt visited our campus. And as with Dr. Yalow, the topic of women in science was discussed. Both Dr. Yalow and Baroness Platt were invited as visibly successful role models for women in science. While there is some doubt as to the effectiveness of female role models, I don't want to get into that here, but will instead talk about images/messages that such role models portray. The most prominent messages that I heard were:

1. A woman can be successful scientist, she can balance family and career, provided she has the determination and necessary skills or intelligence. There are no gender barriers.
2. A girl/woman "needs more than a flirty eye", she needs "scarce skills". She can be feminine and an engineer.
3. Affirmative actions are not necessary to balance the numbers of men and women studying or working in science.
4. Nothing about the way science is taught or the conditions of work has to change.

I enjoy my work, and find laboratory research a highly addictive and compelling activity; on the other hand, from my own personal experiences, from my observations of other scientists and staff and from the literature on women and minorities in science, it is clear that some aspects of the training and practice of science must change before I would want to wholeheartedly encourage more women and minorities to join me in the field of science.

While it may be useful to show girls and women, that women can be successful in scientific endeavors, we must not lose sight of the fact that simply attracting more women into the study of science is only a partial solution to the gender imbalance problem. The gender imbalance is not due solely to a lack of women studying science. What about the attrition rate for women students - is it not higher than for men? And what about the lower proportion of women who obtain tenure track appointments in universities? And what about daycare and parental leave? And what are the careers?

I think it is important to recognize (and I quote from *Science*, Mar 92) "that women who have made it to the upper ranks of the establishment tend to de-emphasize negative gender-specific influences in their field." Similarly, it has been said that we must (and I quote [Rossiter, 1982] "shift our focus from analysis of exceptional women (i.e. visibly successful women) to that of the more usual pattern of women working in science", the ordinary scientists who are the norm and who face a number of barriers in their work experiences. Six years ago, at the Annual Meeting of the Society for Neurochemistry, I attended a special meeting of Women In Neurochemistry where the topic of whether or not there were problems for women in neuroscience was discussed. Of the 40 or so women there, only two thought there were gender problems. And yet at this same conference, as at all scientific conferences I've attended, virtually all of the invited speakers were men. This lack of awareness or de-emphasis of gender-related problems amongst successful female neurochemists clearly corresponds to what has been reported many times in the literature.

I am an ordinary scientist. And I suppose you could call me successful - depending on which criteria you choose. My career path has been 'atypical' compared to most male scientists, but is probably 'typical' compared to female scientists. I never planned to be a research scientist - it just emerged over the years, the critical factors being:

1. encouragement to enter science by my older brother who loved chemistry
2. academic ability
3. luck: - entering university in the mid 60's - the Sputnik era
    - good relationship with my masters' thesis supervisor
    - being in the right place at the right time to get a job
4. economic realities - without a Ph.D. I was not receiving the salary though I was doing research work which I thought was equivalent to those with a doctorate.
5. stamina - being able to withstand isolation or find solutions to it.

Who are the players in the field of science? The pipeline model tells us that for every 2000 9th grade men who enter a science program, five obtain a Ph.D. while only one in 2000 9th grade women graduate with a Ph.D. in science. But is this elite group the most appropriate in terms of who actually is studying, researching or working in the natural and engineering sciences? Who are the players in the field of science? I have looked at the statistics at the University of Saskatchewan - the approximate picture in Agriculture, Natural, Life and Physical Sciences, Engineering, Pharmacy, Medicine and Vet. Medicine 1989/90 was:

	Total	**Females (% of total)**
Undergrad and graduate students	5700	1815 (32%)
Technicians	150	66 (37%)
Research Technicians	320	170 (54%)
Science Faculty	420	15 (4%)
Research Scientists & Others	100	20 (20%)
	6690	2080 (31%)

Looking at the numbers tells us quite clearly how skewed the distribution of women is within the major 'occupational' categories. From the perspective of women working in sciences, the research technician group (who are employed on grants and contracts) is the largest employee group. And the relatively large percentage (20%) of women in the Research Scientist category supports other data indicating that female Ph.D. scientists are not hired into the tenured faculty positions. There were only about 15 women in faculty positions in the sciences (data were obtained from the Academic Calendar listing and personal knowledge of the gender of individual faculty.) In terms of the numerical representation of women in the university science community, then, it would be more appropriate for us to pay attention to the Technicians and Research Technician,s who for the most part have been ignored in discussions of women and science.

How does all of this relate to the conditions of work? Well, the most obvious is that the majority of women work as technicians, and it's time we began to acknowledge their stories. I can speak only from my perspective, though I did work as a technician for several years. It is my belief that if women ran science, that is if women were the majority in all occupational categories, that the conditions of work would change and they would change in ways that would benefit both male and female scientists. Moreover, if women ran science, this would benefit the practice of science itself in terms of the questions posed, interpretations of the data and the ways in which research is conducted. I also believe that women ran science, we would soon initiate changes that would result in an equitable sex ratio of people studying and working in the field of science.

What would the conditions of work in science look like, if women ran science. In order to envision this, I have taken the approach that Gloria Steinem took when she wrote the article "If men could menstruate". What Gloria Steinem did in this article was to adopt a male perspective on menstruation, as if it were men rather than women who menstruated. Essentially, she conjectured that menstruation would become a prestigious process that men

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would brag about rather than something that was a taboo topic. so let's adopt a similar strategy and imagine what it would be like, if suddenly at the snap of our fingers, the gender ratio of the professionals teaching and researching in the various science departments at this university were reversed. Suddenly we women would be in the drivers' seats as it were. What would we see and what would the conditions of work look like for the men?

What would we see?

- there would be no men among the faculty of the Chemistry department
- and no men in the Physics department
- and no men in the Geological Sciences department
- and only one male faculty member in Engineering
- only two men in the Biology faculty
- and only two men in Mathematics and Statistics
- and so on. You get the picture.

And to make matters worse, most of the men would be in the lower professorial ranks.

And if women ran science: What would it be like for the men? Would the only man in the department:

feel isolated or marginalized - as though he were invisible? Would he be treated differently than his female associates? Would he feel that his actions were expected to be representative of men as a group? If he failed, wold it be attributed to his gender? Would he be expected to use masculine force as opposed to feminine wiles? Would he play down his masculinity to blend in with the group? Would he fear being sexually harassed by higher ranking females? Would he have to monitor his behaviour to prevent unwanted sexual attention? Would he be treated maternalistically by the older women? Would we take greater interest in his personal and domestic responsibilities than we would of our female associates? Would we talk about how he was as comfortable and efficient in the laboratory as he was mowing the lawn or performing his other domestic duties? Would he be asked how he balanced his career and family?

I hope you found this exercise useful. Let's snap our fingers and come back to reality. For hundreds of years women have been underrepresented in science, and suddenly it becomes an issue. Why? Is it because men are no longer choosing to work in science? The number of students who are pursuing professional careers in the sciences is declining, and there is a fear that there will in fact be a shortage of scientists in the near future. It is important to recognize that this general decrease in the appeal of science as a career choice has not generated a move to change whatever might be lacking in the training or opportunities in science, but instead what has developed is a move to attract women and minorities to science. Presumably this move arose because of the very large size of the recruitment pool represented by women and minorities. While the attrition rates of undergraduate science students has been described as alarming - for both sexes - we are still losing proportionally more women than men. It would seem logical to fix the pipeline before we run more women - or men - through it.

From the reviews and research articles that I have read, there have been at least two major types of factors identified that impede women more so than men in their work, including working in science. One is what has been called the "chilly climate" a euphemism for the various types of behaviour that constitute sexism or discrimination on the basis of gender. The second major factor is what has been termed the "double burden". In most families in this society, it is usually the woman who is expected to put family before career. Both of these factors have to be addressed in changing the workplace. Whether it is the woman or the man or both who assume responsibility for childcare, the institutions where we work will have to change to accommodate the basic need for family care, before we can achieve gender parity, and of course, to achieve equality, we will also have to eliminate discrimination on the basis of gender and ethnicity.

I owe one of my concluding remarks to one of the technicians in my department. She said "if going back one week after having your baby is having it all, then, I'm glad I don't have it all." Clearly, it's time to move away from having to choose between family and career - we need to get away from dualistic thinking and offer more than either/or options for both men and women.

Though Rosalyn Yalow was able to balance her family and her career, Andrew Schally, who along with Roger Guillemin shared the Nobel Prize for Physiology and Medicine in 1977 with Rosalyn Yalow, apparently did not. An excerpt from the book The Nobel Duel indicates this.

> Even now, Andrew Schally is a man who lives for his work. He spends most of his waking hours in the laboratory, weekends included. Some years he can be found there even on Mardi Gras, the day when the rest of New Orleans abandons itself to pre-Lenten bacchanalia ... His first marriage eventually failed to withstand his dedication to his work.

Clearly, the conditions under which we work should accommodate us rather than us accommodate to them.

SCIENCE EDUCATION AND SCIENCE CAREER FOR INDIAN WOMEN FROM METROPOLITAN CITIES

SUDHA GANGAL, CANCER RESEARCH INSTITUTE, BOMBAY, INDIA
PRESIDENT, INDIAN WOMEN SCIENTIST'S
ASSOCIATION.

About 50% of over 850 million people living in Indian subcontinent is a female population. Neglecting the development and utilization of this large womenpower is a colossal loss to the development of the country. This fact is realized not only by the intellectuals of the country, but also by the Government. Mahatma Gandhi, the father of the Nation, often said that educating a woman in the family is as good as educating the whole family. Attempts are being made at the upliftment of women at all levels, however the pace is still painfully slow, and it will take years of hard work for the acceptability of equality of women in the present day social structure in India. Here we review the status of women in science and technology in the so called urban "white collar" population [minus the urban slums] belonging to lower and upper middle class, which makes up the majority of the urban population, that is about 20% of the total population of India. The data presented here are no doubt biased, in the sense that they are drawn from a few educational/professional institutions and organizations.

Nevertheless it could be considered as representative of the Indian urban middle class population, committed to academic and educational betterment.

In India the educational pattern is 10+2 standards in schools and junior colleges, 3 years of graduation in the senior college followed by post graduation. Most of the schools are Government aided co-education schools catering to a large number of students as evident from one representative school which has about 5600 students. Generally the number of boys and girls admitted to the school are equal, and equal numbers do very well in the merit list at the school leaving examination. There are more female science teachers in schools. They do not need additional qualifications than the men, and they teach all the subjects in the schools. Same is true with the junior and senior colleges, where girls opting for science subjects for graduation is even higher, and about 1/3 to 1/2 secure positions in top tens. Although science teaching staff in junior and senior colleges have larger number of females, very few of them are professors or heads of the departments. From here on we see a difference in student's choice for post-graduate studies. Girl students generally select Biological sciences for research or go in for medical education. While more boys opt for Physics and Mathematics for research, or polytechnic for their post graduation. In Medical colleges large number of girls do post graduation in anaesthesia, obstetrics and gynaecology. They hardly

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choose surgery, orthopedics, neurosciences, thoracic sciences etc. We see a large number of girls wanting to do Ph.D in life sciences. they do better than boys in the interviews and get selected for the Ph.D programme. This could be because the research career is not paying, and really good male students are not attracted to research. The males in India are mostly the main financial supporters of the family. The boys therefore select paying professions such as engineering, medicine, accountancy or business management. In the four major research institutes conducting biomedical research in Bombay, in last five years, amongst the 185 students receiving post graduate degrees 137 [74%] were girls. Women also hold good positions in their research careers. Data from four institutes in Bombay again show that about 50% of senior scientists positions are occupied by women. Three medical colleges in Bombay have women deans and one research institute has female director. Several women have positions as heads of the departments in research institutes and medical colleges.

However, when we analyse the data on women engineers, the picture is quite different. A 15 years survey on women engineers conducted by Dr Parikh & Prof. Sukhatme of the Indian institute of Technology Bombay, from 17 institutions all over the country, it was seen that the percentage of women enrolling for engineering increased from 0.78% in 1975 to only 8.45% in 1988. While, the percentage of graduates increased from 0.68% in 1975 to only 8.45% in 1988. The total number of women engineers in 1975 was 51 which increased to 2623 in 1988. Women generally prefer electronic and electrical engineering followed by civil engineering. Computer sciences came into vogue only during mid eighties, which is now picking up as a major discipline selected by women. However, the employment status of women engineers is still very poor. About 26% of women engineers are unemployed. Out of the total engineering staff employed in various sectors it is pathetic to note that only 8.8% women get employed in teaching institutions, 3.9% in R & D sector, 3.6% in public industries, while only 1.5% are employed in private sectors. Women engineers often have to break their employment and they find it very difficult to seek a job again. The reasons for their break interestingly, are non conducive professional environment (26.8%), pregnancy (19%), marriage and transfer of husband (14.2%) etc. It was astounding to see that about 1.3% women engineers leave their jobs because of inappropriate behavior of male colleagues! Most interesting are the women engineers' perceptions regarding low representation of women in engineering. A lot of them (33.5%) felt that parents' discouragement was the main cause of girls not choosing engineering profession. It was surprising to see that the teachers do not positively encourage the girls to take up engineering career. Other reasons were : the field restricts marriage opportunities (since we still have a majority of arranged marriages), women being considered masculine, jobs being demanding, male colleagues' resentment, unacceptability in the society and above all, business community not wanting women engineers! All this means that there is an urgent need for awakening of parents, teachers and prospective employers towards the capabilities of women engineers. Changing social pattern and acceptability will obviously take its own time.

After all the qualifications that the women achieve in basic sciences, medicine and engineering, are they considered at par with the male scientists, professionals and academicians? This issue could be analysed by studying women's' participation in management of science at National level, in Academic bodies, science policy making bodies, science funding agencies, editorial boards of scientific publications etc.

Indian National Science Academy and Indian Academy Of Sciences are the two apex science academies in India. These academies have top scientists from all the disciplines as their fellows. The academies deal with International collaborations, advice Government on various science policies, hold conferences, decide merits for National awards, have their own scientific publications etc. Fellowships for the Academies are very prestigious and one has to have contributed well in the chosen field to get nominated and elected as a fellow. It is disheartening to note that out of the 628 and 698 total fellowships of these two academies there are only 12 and 15 women fellows! There are about 8 to 10 fellowship selection committees of the academies belonging to different disciplines. Women representation on these committees is only in the field of medical sciences. Very few women scientists get nominated for the fellowships. The academies handle selection of candidates for at least 40 awards given to outstanding scientists. Of these, over the last couple of decades only a couple of women scientists have been the awardees, that too mostly in biomedical research. On the other hand, awards given to young scientists for their doctoral and post-doctoral research have been bagged by 22% girls during last five years. Therefore apparently, up to this level, the women seem to do well.

As far as women's contributions in management of science publication is concerned again, we cut a sorry figure. Out of the selected representative 17 Indian scientific journals having a total of 266 Editorial Board members, only 15 are women, that to on journals belonging to biological and medical sciences. About 16% women scientists are on the review panel of a journal to review the suitability of publication of scientific articles.

The main agency for funding scientific research in India is the Department of Science and Technology of the Ministry of Science and Technology. The apex body of DST is Science and Engineering Research Council [SERC], of which the topmost scientists are members. Since 1975, there has been only one female scientist on the SERC, thrice for the duration of three years. Next to SERC are Project Advisory Committees [PAC] belonging to various disciplines which look at the projects submitted by the scientists for funding. About 72 PAC members handle the 6 PACs in Life Sciences which is a preferred discipline by women. During the last three years only 10 women scientists have been the PAC members, one of them being the Chairperson of one [medical] PAC. With all the women power in science in India, it is difficult to digest that very few submit projects for funding as Principle Investigators. In last three years, out of 40 projects sanctioned in Chemical Sciences and 91 in physical Sciences, none was given to a woman scientist as a PI, while out of 80 projects sanctioned in Life Sciences 10 projects had women scientists as PI.

Thus, from the foregoing account of women in science in a developing country like India, several important points emerge out. Firstly although the general level of education in India is low, from amongst those who do take school and college education, the girls equal in numbers or even outnumber the boys and do equally well in merit in school and college graduation. The number of girls entering in the area of research in Life Sciences and those going in for Medicine is more than boys, but very few girls choose Engineering as their career, mostly because of the discouragement of parents and teachers. Boys prefer to take up earning jobs after their post graduation, while girls continue to do research or take up teaching profession.

There is no discrimination against women in these jobs, and they do secure positions of professors or Heads of the departments. However, in Engineering they are discriminated against, and most of the employers do not want to employ women engineers. Many of the women engineers have remained unemployed or have had to leave their jobs because of their womanly duties. When it comes to achieving the decision making position or being in a position of science manager and getting recognition as top academician, very few women get that distinction. The main reasons could be at this position the job becomes more demanding, involves travel & delinking with family, a need to develop a knack for arguments, discussions, aggressiveness, a need of gathering knowledge about branches of science other than your expertise, taking part in science politics & gossip etc. in which perhaps women fall short. At this point science suddenly becomes a "man's domain". At this stage women scientists not only from India, but also from the developed countries should learn to counter act the patronizing attitude of the male colleagues and their polite acceptance of you only as a woman and not as a scientist of equal status.

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OPENING SCIENCE AND TECHNOLOGY

Barbara Hodgson

Open University , Milton Keynes, England, U.K.

ABSTRACT

Over the past twenty years the Open University in Britain , a university which teaches adult students at a distance, has been successful in recruiting large numbers of women, especially those with no formal qualifications, into degree level study of science and technology. Ways in which this has been done will be briefly reviewed. While we can be proud of our recruitment achievements, the retention record is another matter. Many women come into the University studying science or technology foundation courses but do not continue to graduate as scientists or technologists. Do women not want to become scientists or do they not want to study the kind of courses the University offers? This paper will examine the failure of current course provision to attract women students; discuss courses currently being developed which may more accurately suit women's needs; reflect on intervention measures to make the current curriculum more accessible to women; and reflect on the success of additional measures of support offered to women studying science and technology.

INTRODUCTION

The Open University (OU) is the largest and most innovative university in the United Kingdom with more than 200,000 people currently studying its courses. 50% of these students are women. There are two main characteristics of the University which make it potentially attractive to women, and to women wanting to explore science and technology - it is a distance teaching university and has a policy of open access.

How the OU teaches All OU teaching is "at a distance". The courses come to students in their own homes or, sometimes, places of work. Courses and teaching materials are carefully designed to meet the needs of home-based students. A flexible, multi-media teaching system has been developed which includes specially-produced study texts, local tuition and support, short residential schools, home experiment kits, computer software and networks, audio-visual materials and broadcasts on national radio and television. Although students learn at home, there is plenty of support and human contact available. All registered students have a local tutor and counsellor, whom they can meet along with fellow students at one of the network of over 250 study centres throughout the U.K. Telephone and correspondence tuition and support is also provided.

Open entry No entry qualifications are required for OU courses other than higher degrees. The only requirements are that applicants be adults resident in the U.K., or elsewhere in Europe. The number of students able to study a particular course each year may be limited by staff and resources but the basic principle is to accept anyone who genuinely wishes to study. Admission is broadly on a first-come, first-served basis. Open entry has considerable implications for the structure, teaching and support of courses but allows students to explore areas and levels of study from which they might otherwise have been excluded.

Programmes of study in Science and Technology The largest single group of OU students are studying for a BA or BSc degree (86,000 in 1993). Degrees are awarded on a credit-accumulation basis and students need a minimum of 6 credits, which is equivalent to three years full-time study. Courses are offered as full or half credits and the amount of work typically expected on a full-credit course involves 12-14 hours study per week over a nine month period. It is University policy not to offer sufficient credits within a discipline to allow single discipline degrees; otherwise students are free to make up whatever degree profile they choose. Each faculty offers a multi-disciplinary foundation course and students must start with a foundation course. This starting point is usually, but not necessarily, an indication of the area in which their studies will continue. The Science Faculty has departments of Physics, Chemistry, Biology and Earth Science and among them they offer 27 courses. The Technology Faculty currently has 24 courses from the disciplines of Systems, Design, Electronics, Engineering Mechanics and Materials. The Mathematics and Computing Faculty has 24 courses and some Psychology and Information Technology courses are offered in the Social Science Faculty profile.

WOMEN STUDYING SCIENCE AND TECHNOLOGY IN THE OU

The tables in Figure 1 show the percentages of women students following Science and technology courses over the last few years.

Foundation courses The figures for all 5 foundation courses (Mathematics, Science, Technology, Arts and Social Science) represent those students initially registering in the undergraduate programme (total of 18,124 in 1991). The percentage of women has increased by 3% between 1986 and 1991. Overall the proportion of women students in the undergraduate programme (and graduating) is much the same. It was 27% in 1971 (the University's first year of teaching), had risen to 43.6% in 1981 and to 47.7% in 1991. Inspection of the trends for individual foundation courses shows that the percentage of women students on the Science Foundation course, while lower than the overall figure, has risen at the same rate over the same period. Technology has a considerable smaller percentage of women students and while the percentage was increasing it has started to decline. This is of particular concern as an access scheme, which is described below, was instrumental in increasing the percentage of women on the Technology Foundation Course from 18% in 1979 to 28.9% in 1989. It is possible that a new version of the course, which now includes computing and the need to have access to a p.c., may be negating some of the success of the access initiative.

Higher Level Courses The percentage of women overall in higher level Science courses remains quite good, indeed is slightly better than the Foundation course figures. However this overall figure masks a wide variation from over 50% on Biology courses to under 20% on Physics courses. The picture in Technology is much less healthy. It appears that

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Figure 1. WOMEN STUDYING SCIENCE AND TECHNOLOGY IN OU

Information taken from Equal Opportunities - Statistical Digest Volume 2 (Faculties) 1992 and Equal Opportunities Statistical Digest 1991

Numbers on foundation courses, change over time

1. All foundation courses (Gender breakdown)

	1986	1987	1988	1989	1990	1991
Female %	44.9	46.1	47.8	46.7	48.1	47.9
Male %	55.1	53.9	52.2	53.3	51.9	52.1

2. Science foundation course

	1988	1989	1990	1991
No's All students	4043	4279	3959	3996
Female %	35	36.7	36.5	38.2
Male %	65	63.3	63.5	61.8

3. Technology foundation course

	1988	1989	1990	1991
No's All students	4425	4912	4338	4099
Female %	26.1	28.9	27.8	25.3
Male %	73.9	71.1	72.2	74.7

Numbers on higher level Science courses, change over time

4. 2nd, 3rd/4th level Science courses

	Female 2nd level %	Male 2nd level %	Female 3rd/4th level %	Male 3rd/4th level %
1988	40.4	59.6	41	59
1989	39.4	60.6	41.9	58.1
1990	41.1	58.9	41.7	58.3
1991	38.8	61.2	40.6	59.4

Numbers on higher level Technology courses, change over time

5. 2nd, 3rd/4th level Technology courses

	Female 2nd level %	Male 2nd level %	Female 3rd/4th level %	Male 3rd/4th level %
1988	13.7	86.3	13.4	86.5
1989	14.3	85.7	12.9	87.1
1990	15.3	84.7	11.7	88.3
1991	16.1	83.9	11.6	88.4

nearly half the women students coming into Technology do not stay to study the faculty's 2nd level courses and even fewer go on to the 3rd and 4th level. Detailed analysis would show that the majority who do stay are likely to be found in the so-called "soft" disciplines of Systems and Design.

Women teaching Science and Technology in the O.U. Figure 2 gives an indication of the proportion of women among science and technology staff in the O.U. The overall percentage of women academic staff in the University is 30%. As is the case in the rest of higher education, most women staff are concentrated at the lower levels. There are no women senior staff in Technology (in any discipline), in Chemistry or Earth Science and only one (albeit a professor) in Physics. A reasonable number (35%) of the University's Tuition and Counselling staff, the part-time staff responsible for teaching and academic counselling of students, are women and here the Science Faculty is about average. The Technology Faculty is still comparatively very low although a substantial effort to recruit more women over the last few years has improved matters. Interestingly it has been suggested that work as a part time tutor for the OU has kept many women scientists and technologists in touch with their careers whilst they are at home undertaking caring responsibilities.

Figure 2 WOMEN TEACHING SCIENCE AND TECHNOLOGY IN O.U.

Information taken from Equal Opportunities Statistical Digest 1990

Staff, gender breakdown, and changes over time.

	Central academic staff		Tutorial & counselling staff		
	1988/89	1992	1988	1989	1992
Science % women	17	20	29	30	34
Technology % women	5	8	8	10	14

SOME INTERVENTIONS

There have been, or are being, a variety of intervention strategies developed and deployed to increase the number of women studying science and technology in the University and to broaden the opportunities for them to include some science or technology in their programmes of study. They are all in some measure effective and several of them are described here briefly.

Access, preparation and publicity The most sustained and measurably successful access initiative for attracting women students to OU Science and Technology courses has been the Women in Technology Returners Scheme. The scheme offers bursaries for women who wish to return to a career in science and technology and pays their course fees for them to enrol on certain OU Science and Technology courses. Since 1982 800 women have benefitted from this support. The residential introductory weekend, with which the scheme starts, is an important factor in the scheme's success as it enables the formation of a women's support network at the outset of their studies. The scheme also provides educational and vocational counselling and work placement to encourage women in their return to the labour market. Successful though this scheme is, its funding base is precarious and the university can only run it when external funding is available. A look at school leavers' qualifications a decade ago shows that only about 25% of passes in science and technology subjects were gained by girls. This suggests that mature women are unlikely to have conventional university matriculation requirements to study science and technology courses so the open entry policy of the OU is an important factor in attracting women to study in the science and technology area. It is even more successful if backed by access and preparatory courses. There have been a variety of regional/local preparatory schemes and the Science Foundation course has always provided diagnostic support and preparatory materials for its associated mathematics. In 1993 "Into Science", new preparatory materials for Science Foundation course students will be sent to all students registering for 1994 and will also be available as a pack for sale, suitable for use in further education colleges and community access courses. A Women into Science and Engineering (WISE) Group was set up in the University in 1984 with the aim of increasing participation of women at all levels in science, technology, engineering, mathematics and related fields. Its work has contributed to the increase in women taking the Technology Foundation course (Fig. 1) and to the increase in women part-time staff in Technology (Fig. 2). It has produced career advice materials and also publicity and display material, radio and TV programmes to encourage recruitment to mathematics, science and technology courses.

The Science Faculty Equal Opportunities Policy In 1990 the University approved a Statement of Principle on equal opportunities and agreed a five year action plan for implementing equal opportunities policies. All units are required to develop their own plans. The plan put forward by the Science Faculty lays considerable emphasis on the curriculum as an area for attention. It states "*the Faculty's primary equal opportunities objective in the curriculum area is to increase the proportion of women studying science courses*". A series of workshops on *Gender and the Curriculum in Science* was organised in order to increase awareness within the Faculty of the reasons for the gender imbalance (Fig. 1) and to explore ways of correcting it. Following these workshops, strategies were proposed for making science courses more gender inclusive and these strategies will be tried out in the remake of a second level physics course due for presentation in 1994. A series of discussions have examined all aspects of the course and of course delivery and have considered whether particular changes can be made that will increase the course's appeal to women and improve their success rate.

Science Education Courses Over the last decade the OU has become a major provider of in-service education for science teachers. It has been particulary active in supporting teachers responsible for teaching science and technology in primary schools. The majority of these teachers are women and many of them have little knowledge of science, especially physical science. There has been considerable scope for the provision of courses to enable these women to learn some science as well as to develop their teaching skills to encompass the teaching of science. The Science Faculty Equal Opportunities policy also sees a role here. The suggestion is made that a major reason for the under-representation of women in the University's Science courses is the gender stereotyping that is widespread in homes, schools and the media. A part can be played in countering such stereotyping in schools by including material on equal opportunities in the courses produced by the Centre for Science Education for Science Teachers. Material on gender issues is included in courses for physics teachers and for chemistry teachers and also in the forthcoming Science Education Module for the MA in Education.

Broadening the Science Curriculum Because of the credit accumulation system and the freedom to choose a degree profile, OU students can be encouraged to study some science or technology, especially if the courses are sufficiently attractive. In 1991, the OU awarded 6832 Bachelors degrees. Out of the 3378 women who graduated, 33% had gained credit in at least one science or technology course. The comparable figure for men was 68%. Because of the way its courses are produced, by teams of academic staff including additional experts from outside the university if necessary, the OU is in a very strong position to develop innovative inter-disciplinary courses. Some courses have been developed which are likely to appeal particularly to women and, because they include contributions from, for example, social science disciplines as well as science and technology, will attract 'non-science' students and give them an introduction to some areas of science which may lead to further study. One example is the course *Health and Disease* which draws on current research in social sciences, medicine, history and biology. *Environment* is another interfaculty course which introduces basic concepts, processes and problems relating to environment and spans scientific, technological, social scientific and philosophical approaches. The *Issues in Women's Studies* course is similarly wide-ranging drawing on feminist work in arts and science, technology and social science.

In conclusion Over the past 20 years the Open University, U.K., has had considerable success in increasing the numbers of women studying science and technology courses. In 1973 18% of undergraduate applicants to study foundation courses in Science and Technology were women. In 1981 this figure had risen to 31% and by 1992 even further to 35%. A variety of interventions, both within the mainstream of the University's operation and additional to it, have contributed to this success. However, retention of women on higher level science and technology courses is less successful. In Science, although the percentage of women on higher level courses is the same as for the foundation course, this is mainly due to the number of women choosing to study biology. Ways must be found of attracting women into physical science courses. In Technology only about half the women on the foundation course go on to follow higher level specialist technology courses. Ways must be found to encourage women who have been successful in introductory courses to pursue studies in technology.

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GIRLS AND WOMEN: SCIENCE EDUCATION AND SCIENTIFIC CAREERS IN AFRICA

Esther N. Mwangi and Suliman Essuman
International Centre of Insect Physiology and Ecology (ICIPE)

Africa's active population exceeds 200 million, two thirds of whom live below the poverty line. As women comprise about 50% of Africa's population their performance in all areas of life cannot be ignored. Their role in agriculture, as managers of the environment and homemakers is undisputably important. There are many documents written on the performance of women in general education and women in development.

According to a World Bank report on Sub-Sahara Africa in 1988, there is little difference in male and female school enrollment at primary school level. However, the proportion of women decreases progressively with higher education through high school and university. The decline of women in science over the years is even more marked. There are very few studies done to investigate why fewer women take science subjects compared to those who take arts. Eshiwani (1983) concluded that women do not do well in Science and Mathematics because of structural, cultural, environmental and psychological phenomena. In her study on Kenyan women Riria-Ouko (1984) showed that female students have not performed as well as their male counterparts especially in the lower education. Research on the performance of women in science has largely been ignored and special attention on girls' education must be shown.

It is important to point out the various roles which should be played by society, parents, educational planners, policy makers, governments, international donors and women themselves to bring about change in the education of women in science in all levels of education. The analysis should especially deal with what measures should be taken to create more jobs for African women, and what the top women scientists can do to help this course, as well as discussing what needs to be done to rectify these anomalies at pre-primary level, primary level, secondary level, university level and career level.

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CAREERS & CLOSURE: The Differential Career Paths of Women and Men in Engineering in Canada

Valerie S. Norlen
Carleton University, Ottawa, Canada

Introduction

Based on the diverse literature which suggests that women and men in engineering are differentially distributed in terms of occupational status, earnings, organizational position and sector location, an analysis is proposed of the extent to which their differential distribution can be associated with labour market criteria and individual characteristics. It is hypothesized that women and men may be subject to different career paths which operate as a form of social closure against women, restricting their access to higher positions in the engineering hierarchy.

This paper briefly outlines a research design which investigates the way in which labour market structures, individual characteristics and career paths interact to produce differential outcomes for women and men in engineering. In the following sections, the methodology suitable for such an analysis and the relevant literature is reviewed in connection with four areas of inquiry: (i) career paths; (ii) individual characteristics; (iii) labour markets; and (iv) capital sectors.

Sample Considerations

To collect data about career paths, the sample will include equal numbers of female and male engineers, ensuring that respondents have a minimum of ten years of employment experience. With the aid of a short survey, respondents will create a profile of their work history from occupational choice to current position of employment. Sources for respondents include professional associations (e.g., Canadian Council of Professional Engineers), women in science and engineering societies (e.g., Society for Canadian Women in Science and Technology), corporate associations (e.g., Mining Association of Canada), as well as university alumni associations. Various federal and provincial government departments (e.g., Employment and Immigration Canada, Status of Women Canada) may play a supporting part. However, there still remains the problem of 'invisible' science workers, i.e., those who have training in engineering but have the left the profession.

The Importance of Career Paths

Organizational theorists who study engineering, such as Whalley (1986) and Zussman (1985), argue that career paths tied to bureaucratic organizations bestow access to increasing degrees of security, money and autonomy. They also note that having an early and orderly promotion history is linked with high occupational attainment. This implies that if women are less often promoted early and are more likely to have fragmented promotion histories, then women may be subject to a mechanism of social closure. Parkin's (1979) concept of social closure refers to a process by which rewards are maximized for some when access to resources and opportunities are restricted to a certain group of eligibles. Since professional 'eligibles' in engineering are overwhelmingly male, intra-occupational social closure may benefit men by undermining women's access to positions with higher pay, power and autonomy.

The dependent variable in this research is conceptualized as occupational status, and is operationalized as a five tier career ladder (qualified, experienced, supervisory, managerial and executive). Position on the ladder is ascertained at six 5 year intervals (where the engineer's length of time in labour force permits): 1st year, 5th year, 10th year, 15th year, 20th year after graduation, and at time of survey (if different than above). Engineers will be asked to provide information about their exact occupational title, discipline of work, company of employment, salary level and main work activities at each time interval. At this point of the analysis, there are two independent variables: (1) career mobility - stable or unstable; and (2) promotion history - early, late, continuous, or fragmented. To answer questions about the relationship between promotion history, career mobility and gender, a comparison will be carried out of the female and male engineers' responses at each of the five levels of the career ladder, broken down by the four promotion categories and the two career mobility measures.

The Importance of Individual Characteristics

Those who focus on human capital (e.g., Polachek, 1976) or status attainment models (e.g., Blau & Duncan, 1967) highlight the effect of individual characteristics, such as education and socio-economic status, on entry into and attainment within various occupational levels. Gerstle and Perruci (1969) report the importance of academic credentials in determining professional status for engineering in the United States. Whalley (1986) found that for British engineers technical work experience could compensate partially for formal qualifications.

Six sets of independent variables are used at this point of the analysis: (1) personal status - marital status & family status; (2) family background - parental education & parental occupation; (3) academic qualifications - initial & additional qualifications; (4) acquired skills - on-the-job training & vocational training; (5) work experience - length of time in labour force; and (6) career issues - occupational choice, career aspirations & expectations. A regression analysis will indicate the relative import of individual characteristics in accounting for occupational attainment at different time points in the careers of women and men engineers. If the effects of early status attainment on current status differs by gender, this suggests the possibility of different career paths and social closure.

The Importance of Structural Characteristics

There is a vast literature dedicated to analyzing the effects of core or peripheral industry sector location and internal and external labour markets on employment conditions. Within both economics and sociology, the labour markets of engineers have come under scrutiny. Mace and Wilkinson (1977), for instance, conclude that the concept of the internal labour market is the best framework for explaining the allocation of labour within the engineering labour market.

Based on this literature, five measures of labour market structure are suggested: (1) job tenure - stable or unstable; (2) firm size - small, moderate, & large; (3) firm mobility - inter- & intra-firm mobility; (4) industrial location - extractive, transformative, distributive services, business services, personal services, & social and political services; and (5) industrial mobility - inter- & intra-industrial mobility. To investigate how labour market structures at the level of jobs, firms and/or industries effect occupational outcomes, two regression models will be utilized. The first isolates those individual characteristics found to be significant predictors of occupational status, and adds job tenure, firm size and industrial location. The next model adds the two measures of mobility -- firm and industrial.

The investigation of the effects of labour market structures on engineering work conditions is complicated by the literature which indicates that capital sector location, private or state, can effect occupational outcomes. Given the different qualities which characterize the state and private sectors, any investigation of the effect of labour market structures upon occupational outcomes must consider the interaction which occurs between internal/external labour markets and capital sector location. Two measures of capital sector are used: (1) sector location - private & state; and (2) sector mobility - stable state sector workers, stable private sector workers, & unstable capital sector workers. To examine the relationship between capital sector location, characteristics of the labour market, individual characteristics and career paths, the five levels of occupational status (qualified through executive) will first be regressed onto the two capital sector measures, controlling for all six sets of individual characteristics. Job tenure, firm size and firm mobility, industrial location and industrial mobility will then be regressed onto capital sector location.

Summary

The proposed research focuses on the effects of four groups of independent variables on occupational status in engineering. The first group investigates **career paths** by providing a measure of occupational status attainment at six time points in the career, and relating this to career mobility and promotion history. The second group includes **individual characteristics** (personal status, family background, academic qualifications, acquired skills, work experience and career issues) while the third includes five features of the **labour market** (job tenure, firm size, industrial location, and firm and industrial mobility). The fourth group adds a measure of **sector location and stability**. From each of these analyses the significant predictors are gathered and their cumulative effect upon career outcomes is examined.

As all the analyses will carefully differentiate between women and men in engineering, they will facilitate an exploration of the possibility of social closure. If the proposed analyses find that the independent variables influence occupational status attainment in such a way that women are allocated to lower status positions, this will constitute support for a theory of social closure. In conjunction, if women experience different career paths with earlier career moves having less influence upon status attainment, then this constitutes specific support for the hypothesized mechanism.

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TRANSFORMING SOCIETY THROUGH SCIENCE and TECHNOLOGY: THE CASE OF RURAL WOMEN IN NIGERIA.

Dr. Eunice AC Okeke
Women Studies,
Institute of Education,
University of Nigeria, Nsukka
Nigeria.

Contribution to 7th Conference of
Girls and Science and Technology (GASAT), 1993
University of Waterloo, Ontario, Canada

Abstract:

Societies have been transformed through successful application of science and technology. What has happened in Japan in recent past is a case in point. Many developing countries of the world are vigorously pursuing science and technology in order to transform their societies. Unfortunately, they have concentrated their effort in urban centres providing them with public utilities such as pottable water, electricity, hospitals, schools. Rural areas receive little or no attention. The result is that these rural communities remain characterised by extreme poverty, ignorance, illiteracy, unhealthy environment, high mortality rate, low income, absence of pottable water and electricity etc. Women who constitute the greater proportion of rural population, are the sufferers of the stated deplorable living conditions. The Better Life Programme for Rural Women (BLPRW) established in Nigeria in 1987 is primarily to improve the lives of rural women in Nigeria. The programme it can be said has made significant impact on the lives and aspirations of rural women in Nigeria. This paper describes the plight of rural women, discusses the role that BLPRW is playing in bettering their lot. The paper however argues that the lives of rural women will be more permanently and quickly transformed if some degree of science and technology education is infused into the BLPRW. National and International agencies interested in gender issues can assist in this regard.

Introduction:

In discussing the issue of transformation of societies through through the application of science and technology as it affects rural women, the paper begins with a brief description of the social and economic life of rural women. The role of the Better Life Programme for Rural Women to improve the living standards of rural women is presented. Ways and means of expanding the programme to include scienc education is the import of the paper.

The Socio-economic Conditions of Rural Women:

Except for the few urban centres, much of the environment in many developing countries can rightly be classified as rural. As a matter of fact, greater proportion of the population in these countries live in rural areas. In Nigeria, for instance available statistics show that as much as 80 % of the population live in rural areas, and women constitute 60% of this rural population (UNESCO Report 1986). This is because men and youth migrate to the urban areas to seek for paid labour or to set up businesses or to seek for comfort and pleasure. Women and children remain behind and struggle for survival.

Despite women's contribution to keep families going, social and cultural values portray and place women as inferior to men in intellect and understanding and in productivity. Women are therefore denied the right to self determination and made to be dependent on the men for their social as well as economic well-being. In rural areas where these values deeply persist, the rural women's lives are restricted and unfulfilled,(Okeke,1990). Studies have revealed that African women constitute the major labour force behind agriculture in many developing countries especially in sub Saharan Africa. To be specific, it is the rural women who provide this labour. They plant, weed, tend the cash and food crops belonging to their husbands or to big time male farmers who pay them cheaply for their labour. The women themselves cultivate mainly food crops for family consumption. Where a woman rears poultry and/or keeps goats, they are also for consumption (Boserup,1970).In other words, the rural women's cash income from agriculture is negligible. The full responsibility of food processing is that of women. Watching rural women process cereals and tubers for food, extract palmoil, grind and fry garri etc. using the traditional, laborious methods, evokes pity.

In addition to agriculture, African women engage in petty trading, in mat-making, pottery, weaving, dyeing, sewing etc. to earn income. Even when income from these multiferous activities are put together a rural woman's income remains low. Because the income is insufficient to provide basic human needs, family nutrition, health and general living standards remain poor.

World Bank Reports (1988) show that women in developing countries have very limited access to basic education. The rural women suffer this denial more because those social, cultural and religious factors that have been identified as barriers to the education of women in Africa operate maximally in rural areas. The result is that women in rural areas of Africa lack opportunity to acquire and utilise knowledge, skills and attitudes necessary to adequately function in the present world. For instance, most rural women lack knowledge of scientific bases of many common diseases such as malaria, gastro enteritis, measles, pneumonia, etc.and so are unable to guard against them. Consequently,there is higher incidence of infant and child mortality, maternal mortality, high fertility, malnutrition in rural areas of Africa. Many women lack skills in modern agriculture such as in cropping, application of fertiliser, management of pests, livestock keeping etc. As a result the output from their agricultural efforts is poor. Even in food preservation and processing, there is still a large proportion of women who still hold on to old laborious ways of preserving and processing food. In short, rural women of Africa are yet to benefit from developments in science and technology (Okeke,1990). It is to improve the lives of rural women in Nigeria that the Better Life Programme for Rural Women (BLPRW) was instituted in 1987 in Nigeria. A description of the goals and activities of BLPRW will help to put into proper perspective the efforts being made to transform lives of rural women in Nigeria.

The Better Life Programme for Rural Women:

The BLPRW, the first of its kind in Nigeria and Africa was founded in 1987, by Nigeria's First Lady, Mrs. Maryam Babangida.The main goal of the programme is to alleviate the suffering of women living in rural areas. The strategy is to mobilise rural women to participate fully in all aspects of the development process. As an instrument of change, the BLPRW set has six broad objectives namely:

Objectives:

1.To stimulate and motivate rural women towaards achieving better living standards, and sensitise the rest of Nigeria to their problems.
2.To educate women in simple hygiene, family planning, the

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importance of child care and to increase literacy rate.
3.To mobilise women collectively, in order to improve their general lot and for them to seek and achieve leadership roles in all apheres of society.
4.To raise consciousness about their rights, the availability of opportunities and facilities, their social, political and economic responsibilities.
5.To encourage recreation and enrich family life.
6.To inculcate the spirit of self development, particularly in the field of education, business, arts, crafts and agriculture,

(National Womens Commission, 1991).

It is significant to note that these objectives are related in full or in part to the goals of science and technology education. Objective 2 for instance focuses on health science while objective 6 which talks about self development calls for the acquisition of marketable and income generating skills. Indeed not one of the goals can be fully achieved outside the framework of science education. Thus it can be said that the programme of BLPRW cannot be effectively pursued without incorporating into it some form of education in science and technology.

The Operational Scheme:

The programme operates with Committees formed at different levels: the community/village level, the local government level, the state level and the national level. Each Committee has the responsibility of translating the objectives, setting its priorities to suit its peculiar circumstances, and coordinating the implementation of its projects. All women Cooperative societies are formed as a strategy for mobilising women to be committed in their participation in the various projects.The areas of special interest to BLPRW are health, agriculture, arts and crafts, education, and social welfare.

In the health sector, the BLPRW functions to create among women the awareness of health programmes such as the Expanded Programme of Immunisation(EPI), Oral Rehydration Therapy(ORT), Family Planning and Training of Birth Attendants. In addition they work to bring governments and other agencies to provide pottable water, establish and equip health care centres in the rural areas.

In the area of agriculture, women through farm cooperatives have easier access to farmland, improved seeds/seedlings, fertilisers, funds and credit facilities, extension services,and equipment. In addition, workshops are organised to teach rural women modern skills in farming, food preservation, processing and packaging using labour saving/more efficient devices.

To improve on the quality and quantity of art and crafts products of women, BLPRW mounts skill development programmes. Exhibitions and fairs are organised to publicise what women can do and to serve in marketing their products at good prices. Articles produced include woven cloths,batik as well as tie and dye cloths, wood carvings, pottery, jewellry etc some of which are exportable.

In the area of education,the BLPRW collaborates with educational agencies to encourage women to participate in educational programmes especially in mass literacy programmes. In addition, it has established women education/multipurpose centres which have facilities for integrated curriculum focussing on literacy, numeracy, agricultural studies, simple accounting and book keeping, nutrition,and child care, art and crafts.

Some social welfare projects initiated and supported by BLPRW, include orphanages, old peoples homes, and schools for handicapped. A scheme called Indigent Housing Scheme for Rural Widows is being pursued in one state.

Judging from the number of cooperatives (9,492), cottage industries (1,435), shops (308), markets (187), women education centres (428), social welfare projects (195) etc.the BLPRW has established (National Commission,1991) one can say that the programme is making significant impact. It has succeeded in awakening public interest and concern for the social, economic, educational problems of women. Women themselves are in high gear to explore their potentials and get into all spheres of human endeavour. Be it as it may, there is evidence that rural women do not yet possess that knowledge which form the basis for many of the health, agricultural practices they are asked to adopt. It is because of this that many are reluctant to adopt certain practices while some revert to their old practices when convenient. It is expedient to incorporate science education in any programme for improving the living standards of rural women.

Science Education within the BLPRW.

In addition to literacy and numeracy, rural women have need to be freed from ignorance and superstition. This can be achieved through exposing them to the rudiments of science in ways they can understand and apply in coping with everyday problems of life. What is happening at present is that women are led to consume the products of science such as the fertilisers without knowing the basic principles guiding their utilisation. They are taught for instance,to administer the ORT to a child suffering from gastro-enteritis but they do not understand the principles underlying the practice and the working of the human body. For rural women to appreciate the use of contraceptives for family planning, they have to know something about the anatomy and physiology of their body as it relates to reproduction. Women need to know the relationship between diseases such as malaria and keeping surroundings clean. Indeed, it would be of great advantage if rural women are enabled to acquire some technical skills useful in the home such as the working or operation of some simple domestic gadgets. To this effect, some basic science and technology concepts to be included in the educational programmes of BLPRW, are presented below.

Suggested Content for Science Education of Rural Women

1. Common diseases and illnesses.
    - Description of Common diseases
    - Spread of the diseases
    - Prevention and Cure
    - Immunisation scheme
2. Human nutrition
    - Types, sources and uses of food
    - Balanced diet and deficiency diseases
    - Baby foods and feeding
    - Food preservation
3. Human Reproduction and Child care
    - Reproductive organs in females and males
    - Conception, development of foetus
    - Maternal health and birth process.
    - Care of infants.
4. Keeping healthy
    - Personal cleanliness
    - Family health
    - Community health
    - Health organisations and agencies
5. Diseases of crops and crop management.
    - Economic importance of crops
    - Diseases of crops and management
    - Modern farm techniques; application of fertilisers etc
    - Harvesting, and food processing
6. Energy and appliances in the home
    - Sources of Energy
    - Utilisation of various forms of energy
    - Conservation of energy

7. Machines- care and maintenance
    - Care and maintenance of basic household tools
    - Parts and working mechanism of simple gadgets
    - Care and simple maintenance of some simple gadgets
8. Livestock farming
    - Goat and sheep rearing
    - Poultry farming
    - Fish farming
9. Keeping the environment
    - Pollution; forms, sources and effects on quality of life
    - Erosion and flooding
    - Population growth and control
    - Human activities and environmental degradation
    - Women and the environment

Practical approach is recommended in teaching the above content to rural women. Lots of illustrations must be drawn from daily life experiences of women. Charts, pictures, and other audio visual teaching aids appropriate to adults should be employed. This approach will not only enable the women to gain and apply scientific knowledge, but will instil in them the right attitude to science and technology as required by todays society. In this way the BLPRW would have laid the right foundation for achieving its stated objectives.

Implementation:

The implementation of such educational programme may not constitute much problem since the BLPRW already runs multi-purpose educational centres. What is required is posting science teachers to those centres to teach primary science to rural women. Those teachers however, will have to undergo a short training course on education of adults with special reference to rural women. Alternatively, graduates of adult education programmes can be hired and made to undergo a short training course in primary science.

Since the above content is to be incorporated in the existing curriculum used by BLPRW in the education of rural women, fund for this added programme can come partly from that provided by government for general education of women. The other part can be obtained by soliciting for funds from national and international organisations working on gender issues. Already, it is reported (National Commision, 1991) that agencies such as UNICEF, IITA, UNIDO are assisting the BLPRW. GASAT as an international association of women in science can also assist. One way is for the association to collaborate directly with BLPRW. Another is to link BLPRW to donor agencies and institutions with similar interest who can assist her in seeing that the lives of rural women are transformed through science and technology.

Conclusion:

The lives of rural women especially in developing countries deserve special attention if they have to live in the world that is so quickly being transformed through science and technology. The Better Life Programme for Rural Women in Nigeria, though timely and is making considerable impact appears narrow and needs to be expanded. The suggested expansion is to incorporate into the existing educational programme of rural women, a planned course of instruction in primary science and basic technology so as to better equip them to live more fulfilled and effective lives.

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BALANCING THE SCALES:
STUDYING GENDER ISSUES IN SCIENCE/TECHNOLOGY CENTRES

Joel Weiss, Suzanne Hidi, Barbara Soren
Ontario Institute for Studies in Education
Luigia De Divitiis
Ontario Science Centre

Issues of educational equity are concerned with access to the valued knowledge of a society, and scientific literacy is among the major components of cultural literacy. The attainment of scientific literacy is important for social and personal reasons. At a societal level, increasing the talent pool allows for greater numbers of qualified scientists, engineers, mathematicians and technicians, enabling a more competitive position in a technologically sophisticated world; a more scientifically literate citizen can better participate in enlightened decision-making about science and technology policies. At a personal level, increasing levels of scientific literacy for groups ordinarily left out of this base makes for a more just society regarding self-esteem and standard of living.

Although there may be a number of significant changes taking place affecting the lives of women, their participation in activities surrounding scientific literacy has generated more expectations than realities. Women are still under-represented in all aspects of education and careers related to science, mathematics, engineering, technology. (For example, of the 61,000 members of the Professional Engineers of Ontario, only 2,000 are women.)

Of all the many reasons put forward for this situation (e.g., inherited differences, bias in hiring procedures and equity policies, sexual stereotyping) the development of early differences in interests between females and males represents a major unexplored area for

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research.

There are several settings in which such interests might develop, including formal schooling which has had limited success in cultivating scientific literacy. Informal learning institutions, such as science/technology centres hold great appeal since they allow for learning to be voluntary, self-paced, often interactive and exploratory in nature.

We will report on a program of research being undertaken between OISE and the Ontario Science Centre which looks at gender-related issues. The research is part of a larger project, STEEP, Science Technology, Engineering, and Education Project, a consortium of diverse institutions (OISE, OSC, Professional Engineers of Ontario, TV Ontario, Toronto School Board) concerned with different aspects of science culture.

The current mission of STEEP is:

1. To participate in developing in Ontario a scientifically and technologically literate society by bringing together different organizations involved in science culture.
2. To engage in the development of: a) a research agenda in science and technology literacy, exemplary teaching and learning sites; b) a program of dissemination of the research results through outreach and mass media programming; c) the determination of the need for, and if so, the planning for a Permanent Centre for Science, Technology, Education and the Environment.

Informal learning centres, such as the OSC, are ideal places for ascertaining what children (indeed, people of all ages) are attracted to and engage with as well as how they interact with an exhibit. Since science and technology are often perceived as "masculine," it would be useful to determine whether there are biases in what interests are represented in the various exhibits in the Science Arcade and Hall of Technology. For example, activities involving electricity, magnetism, simple machines, and steam engines may be seen as masculine-oriented, while feminine-oriented interests may be found in exhibits focused on perception, musical instruments, physiology, and health in medical technology. The international literature on students' interests in science is very clear that males are more interested in physics and technology and in understanding how things work, in comparison with females being more interested in the social implications of science and human biology.

Our research agenda on interests includes:

a) analyzing sites within the Ontario Science Centre for determining potential gender bias in exhibit materials and related activities;

b) examining how children naturally attend and interact with materials (i.e., what type of interest they show through engagement and how long these interests are sustained).

c) analyzing school-based curriculum materials and programs to see how they relate scientific interests associated with informal setting of OSC with the aim of providing consistency and balance in interests.

We will describe our proposed research agenda, and other activities related to gender differences within the context of OSC. This includes results from our front-end analysis of the planning of Kidscience, an area for children from 0-8 years; data on career determinants and influences for a variety of populations within OSC and from a sample of professional engineers associated with "Innovations in the School"; and from a follow-up study of graduates of the Ontario Science Centre Secondary School.

Our presentation will take up such issues as defining the concept of interest, the role of informal learning in their development, and the role of research in understanding gender issues.

NEW TENDENCIES IN SCIENCE AND UKRAINIAN WOMEN

Dr. Valentina Zlenko
Institute of World Economy and International Relations
Academy of Sciences of Ukraine, Kiev

According to statistical data (1992) women in Ukraine make up 27.9 million or 54% of the whole population. More than 12 million Ukrainian women are engaged in some form of economic activity. Among them more than 5 million women or 41% of the whole employed have jobs in mental spheres.

As compared to the past, women's achievements in the field of education are obvious. Women make up 51% of the overall number of students at the higher schools of learning and 57% of students of the technical secondary schools. Over 4 million women have higher secondary or technical education. Women considerably outnumber men in the category of specialists with university or college education, employed in economy - they make up 61.8% of those.

Ten years ago the sectoral and industrial structure of female employment had changed in accordance with changes in the total labour force structure. Women accounted for 85% of persons employed in trade and public catering; 80% in health and social security; 75% in education and 72% in culture and art. The employment of women in some traditionally male spheres or jobs, such as engineers, agriculture and economists, had increased but women were still strongly underrepresented in senior administrative and managerial jobs and in most academic and scientific occupations. The labour market on the whole remained segregated along male and female jobs.

It can be stated that process of economic reforms in Ukraine so far has not brought about significant changes in women's standing in economy, higher education and science. Despite educational advantages, improvement of qualifications was much more difficult for women than for men. For many women, however, increased qualification did not lead to promotion at work.

After graduation women's academic careers appear to be much more thorny, than those of men as women largely had the responsibility for children and the home in addition to their wage employment. although women still constitute a great part of the stuff in higher school and scientific research institutes, they have, as a rule, a much lower degree of scientific education. One of the common trends for all the institutions is the small number of women among full professors and academicians - 1%. Women may be the deans of departments, chiefs of chairs, prorectors or deputy directors but they very rarely occupy positions at the top.

Women postgraduates represent more than 40% of all those who engage in research and want to take the first scientific degree, but not all of them will be able to defend their thesis at the end of the course. The main reasons that prevent women's careers in science and education are the following:

- their professional advancement had been largely ignored and limited by traditional stereotypes of womens' roles and functions
- the double burden many women carried at the workplace and at home that in turn reduced available time for professional upgrading
- historical background and the attempts of some political leaders return women at home
- psychological factors, etc.

New tendencies in science, changes in the economy demand the developing a feminist perspective on science, increasing qualified labour force. But according to opinion survey (April 1993) about 50% of women think that economic reforms have brought nothing for them and about 15% think, that they have made even worse.

The entry to the free market economy make women to find new solutions of their problems. We can see the evolution of women's educational and professional orientation as a result of the economic reforms. Results of recent survey carried out on girls during their entrance examinations at University show that 73% of female students were considering higher education and had some type of course in mind. The most popular courses are law, business, management and foreign languages. Engineering, mathematics, chemistry were considered by some of the students as were environmental sciences. The most common response to the question why the students came on the course was they wanted to reach the top position in society, make one's career, to have big incomes. Only a few students were considering engineering and science as a degree course with a view to working in a technological field.

The new conditions of political independence, the move from dictatorship to equality within European community generate huge demands for qualified personnel. This situation eventually requires reshaping and expansion of the system of education and scientific research. But at the present time institutions of higher education and research are in precarious condition due to fiscal crisis and general economic instability.

OVERVIEW OF HOME GROUPS

Patricia Murphy
Open University, Milton Keynes UK.

In the GASAT 6 proceedings, Sue Lewis spoke of the "generally positive experience" that had resulted from the introduction of Home Groups to the GASAT conference. (A Home Group is a small group of conference participants which meet regularly throughout the conference). There were two main reasons for introducing the groups: (i) to help integrate the variety of countries, cultures and languages typically represented at GASAT; and (ii) to provide opportunities for participants to reflect on, and further discuss, ideas and understandings gained during the conference. It was also felt that Home Groups provided a means for new participants to make contacts and develop friendships.

The positive response to Home Groups at GASAT 6 ensured that they featured again in the GASAT 7 programme. Consequently 19 pre-arranged groups were set up of 10 to 12 participants from a wide range of backgrounds. In each group a facilitator was identified whose role it was to encourage and support discussion and to enable the contribution of each individual member of the group. In addition, the facilitator had to take notes and provide a synthesis of these for a Home Group report. The facilitators were given some starting point activities, which they could use if necessary but after the first session it was expected that each group would set its own agenda.

The Home Group discussions were allocated a daily slot in the Conference Programme. On Visitors' day, Wednesday 4 August, each Home Group was expected to receive between two to three visitors. This was to give visitors an opportunity to experience the conference at a different more informal level. The final size of the Home Groups varied from between eight to twelve people and this fluctuated over the days of the conference. This was particularly the case on Tuesday when the late return of the trip to Niagara Falls disrupted the timetable. In many instances as well the visitors we expected failed to materialise. This may have been because it was difficult for them to appreciate the role of the Home Group or the benefit of attending one. The Home Group is not an easily communicable concept and the title is far from self-explanatory. Several of the Home Groups reports commented on the difficulty of integrating late-arriving participants into the group. Most achieved this successfully but had to think hard about what strategies to use. Perhaps visitors to the conference experience discomfort and anxiety about coming as 'outsiders' to an existing close-knit group. We may need to give more thought to this in preparation for GASAT 8.

What was clear from the Home Group reports was that once again participants appreciated the opportunities the Home Groups provided. These were some of the views expressed:

> "I applaud the organisers for continuing with the Home Group format. For me it was a very positive opportunity to laugh with, listen to, and socialise with other feminist educators and to discuss academic and personal matters with them in a comfortable, casual setting which is so often missing in academic conferences."
>
> "The Home Group went very nicely - it is a much-needed, relaxed balance to most of the other sessions of which many are formal and non-interactive."
>
> "Group members liked the concept of Home Groups, and mentioned particularly the opportunity the group gave to get to know new people quickly."
>
> "The general feeling of the group was positive regarding the Home Group experience. We each identified being pleased with the opportunity to tell our stories to a small group, to hear the diverse interesting stories of others and to explore our feelings and learning."

It was apparent that in several cases the original Home Group transformed during the conference to a 'core' group of enthusiastic 'related' participants. Some new participants commented that they would have welcomed a Home Group session prior to the start of the conference (Home Group E). If the Home Group is helping new members make contact and 'break the ice' this may be something to consider for GASAT 8. Other participants were concerned about the mix of the group. "Our group was half-oldies and half-newies - which was a useful mix as the evolution of GASAT could be explained." Several participants mentioned feeling happier in all-women groups and even apologised for this! This comment came from both mixed and all-female groups and is an issue we reflect on later.

Some facilitators expressed anxiety about the level of discussion in the Home Groups. "There was no depth to the discussion. We were too polite and unsure" said one (Home Group T). "I wondered if, at times, it wasn't too cosy and I should inject debate into the discussion" speculated another (Home Group E). Although these worries were shared by only a minority of facilitators, it might indicate a need to give more thought to the briefing of facilitators and to the dilemma members face

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in trying to establish and maintain supportive atmospheres for discussion whilst at the same time "engaging deeply in the challenges and dilemmas associated with the different frameworks used in feminist research" (Home Group L).

An initial focus for discussion for many groups was the **role of GASAT.**

> "The Home Group considered that the major strength of GASAT is the ability to draw together people from the world who come with different perspectives, a range of starting points and understandings about feminism, and a variety of beliefs about how science and/or technology might change to enhance and challenge current paradigms and procedures. These diverse points of view and experience provide for exciting opportunities to share, compare and learn," (Andrea Allard, Group B).

Bev Dick's report for Home Group H also focused on this. This extract from her report provides a flavour of the eclectic nature of GASAT.

> "What brings people to GASAT? Most of our group came to be rejuvenated, or to hear from, and share experiences with others. Talking about ourselves in our first two meetings gave us a good sense of the range of interests and backgrounds of people attending the conference. I include some snippets here because the life of the conference and of GASAT work is not just the wealth of ideas generated and mulled over at the conference, but the spirit of the people who make up this budding network.Both are valuable to understanding the value of this unique assembly of women and men.
>
> Nessy - who is scribing the stories of Australian female scientists aged in their late 70's and older. There seems very little funding for this kind of research - she is doing it mostly as a personal work;
>
> Sharon and Kerry - both have science education backgrounds and now work as private consultants,(in Canada and Australia respectively). Sharon is currently negotiating college-level programs, (design and development), for women and aboriginal upgrades. Kerry is going it alone after being the manager for several years of a very popular science education 'shop';
>
> Kamlesh - who is the head of the teacher education department in her Indian institution and a teacher of psychology, is interested in increasing the number of girls in science education, and in understanding the associated role of primary and secondary teacher education institutions in this;

> Thora - who as a lecturer in mathematics at a university in New Zealand is interested in gender and maths anxiety;
>
> Paula - who has a background in the printing industry, is soon to be head of a technology department in a secondary school. A challenge as the department is traditional and male. She has taught courses to women only groups in technology and in sexual harassment;
>
> Val - who lives just 20 minutes from Waterloo University, is a primary teacher who introduced computers into her school and region and is very involved in technology, science and computing curriculum work;
>
> Ann-Marie - whilst being Swedish, Ann-Marie now lives in Canada. Her scientist, (Chemistry), background has lead now to an interest in education and girls' confidence;
>
> Stella - who with her PhD in applied science, (in Agriculture/Economics), is currently interested in the role of women in fishing communities. She has worked with many science teachers and has been encouraging GASAT activity across Africa;
>
> Isabel - was one of the wonderful Canadian women who volunteered to be a daily helper throughout the conference.
>
> Yvonne - found us on the last day. She was one of the indigenous Canadian women at the conference. As a roofing engineer, her example to her daughter of how to be confident and skilled as a female was obvious;
>
> Bev - from Hypatia's Place - the maths, science, technology education centre for girls in Australia, the McClintock Collective. Favourite work is with teachers in professional development - where the challenge is to change the science/technology curriculum and the way it is taught to make it a more relevant experience for all school girls."

Another report, (Margaret McKinnon, Home Group N), included a good description of the way the Home Groups functioned:

> "We were an eclectic group that met daily. Educators, researchers, and policy-makers we listened to, and told stories of, systemic discrimination that women face as they enter male-dominated fields of work and study. We explored local, regional and national differences in how females in school and

> work learn about and use math, science and technology in their daily activities. We shared suggestions for reform, strategies for individual and collective action, and questions for re-examination. We talked about GASAT: its history and future in reshaping what and how we teach math, science and technology. We discussed issues raised in workshops, symposia, paper-sessions and roundtables. We also talked about our own work and experiences and those of others we had met during the conference."

Some common themes emerged from the Home Group discussions. One was the issue of **who participated in GASAT.** Several groups noted the absence of certain people at the conference - the women entrepreneurs; the professional technicians; the feminist philosophers; the practising scientists and technologists, and young people. Others focused on the missing minorities - the indigenous people; the disabled, etc., yet others noted the continuing lack of representation at GASAT of certain countries, eg., Japan; China; West Indies; S.E. Asia; France, etc. These concerns led to questions being raised:

> "How can GASAT continue to ensure that diverse issues and a range of positions can be 'heard' in ways that will create better understandings? How can the voices of women from non-industrialised nations be listened to and their concerns addressed within and through GASAT?"(Home Group B).

> "How can we engage an ever-expanding group of people in GASAT issues, allowing for multiple starting points as they are appropriate within differing contexts, and still continue to challenge and extend everyone's understandings?" (Home Group L).

For one group, it was essential that GASAT continue to be a "dynamic association prepared to review constantly in order to accommodate inclusion," (Home Group D).

For other groups seeking answers to these concerns led them to question structures within GASAT. For example, they wanted GASAT to remain open to all and not to become an elitist organisation based on 'masculine' models of refereed papers with judgements on the worth of the work made by others operating outside the context in which the work was set. Some members commented on the formality and exclusiveness of some of the processes adopted at the conference. One group asked," How can we be feminist in our processes/practices as well as our products?" They recommended that paper sessions, (symposia), should not be lectures - furniture should be more circular rather than in a presenter/audience arrangement, interaction should be fostered, but "questions shouldn't be used to take over and create a platform for shifting the focus to our own work, we need to create more opportunities for extensive dialogue about our work that will strengthen it," (Home Group L). Related to this concern about exclusivity, one group made a plea for paper and symposium presenters to include in their presentations, "the necessary background information about their countries." "Furthermore," if 'local terminology' is used in presentations, it needs to be defined and when talking of programs it is important to clearly specify the age groups considered," (Home Group B).

Another source of exclusively identified was finance: "Is the cost of attending GASAT prohibitive?" (Home Group H). "How many teachers could afford to come to an international conference even if they had the inclination?" (Home Group B). There were not many solutions offered to this problem. One suggestion was to consider a GASAT journal with a subscription base, another to set up mini GASAT's in different regions which would encourage local participation and was seen as a way of more adequately addressing the objectives of the GASAT Association. The central aim echoed by the groups was to maintain open access to each other and to extend that access. There was clearly some anxiety that whilst having GASAT 8 in India was a wonderful and exciting prospect again, as with other of our international conference locations, certain people and countries might well be excluded simply on the grounds of finance.

Several groups commented on the need for GASAT to take a more direct approach to the professional development of its members. Home Group L asked, "How can we create a mentoring system at GASAT so that we can be mentored and be a mentor?" The group also felt the need for more networking so that we can "support each other in extending our research through the 'windows' that have opened-up through GASAT." Home Group P advocated 'coaching' sessions for members on how to tap into government and private funds to support projects, and sessions to help members establish and maintain their roles as professionals in the science and technology area. These recommendations point to ways in which the GASAT Association might evolve within regions.

The other themes that arose from the Home Group discussions were less to do with process and more to do with the substantive content of the conference papers. One topic, however, with implications for process, engendered much discussion and alternative views. This was the question of working **with men for change.** One group asked what is the appropriate male voice at GASAT? This group welcomed the male presence at the conference but felt the issue needed to be explored further. In their view the implication of, and for, the 'masculine' voice should be an item on a future GASAT agenda. Some groups' comments were more critical. They suggested that we should not spend too much time trying to understand "men at GASAT" as it "takes away from understanding ourselves." This view was echoed in the frustration of one of the Home Group facilitators who commented that her home group discussion on the participation of men felt like "an illustration of male dominance even in the absence of men." She also noted, somewhat ironically, that it was not the man in the group who took up the topic and he often chose to listen more than talk. Some members voiced their unease at the hostility they felt was shown to men by some women at the conference. In their opinion, this weakened GASAT. They asked how high a price did men have to pay to be activists in the feminist movement, (Home Group W). Another group commented on the notion of a 'muted voice' for men at GASAT which in many instances was the voice the male participants tended to adopt reminding us that perhaps "Western women's voices could also be 'muted' a little whilst we learn from others' experiences,(Home Group L). Many groups who welcomed the male presence at GASAT nevertheless agreed the need for some all-women groups. The discussion in Home Group E - (Ruth Carter), about working with men for change was constructive and made the following points:

- they (i.e. the men) hold power, it is naive of us to try it alone.
- exclusion of men creates hostility, get them to grow, gain and benefit through working with us.
- we need to use subversive strategies for raising their (men's) consciousness.
- we need feminist men to be part of existing structures but they need a support group of women (some place where they (i.e. the men) are not perceived as crazy).
- make it a win-win situation - male cadres to take the message to other males.

Another issue that arose during the conference concerned the morality of encouraging women into science, technology and engineering. The effect of "opening the doors" had not significantly affected the hostile environment within, (Home Group R). Another group observed "females who enter math, science and technology courses and workplaces face multiple, social/cultural and religious barriers that limit their active participation in reshaping these environments so that they are more inclusive of groups who are traditionally under-represented," (Home Group N).

Other groups echoed this concern and shared the view that to encourage women to enter hostile environments was ethical "as long as we continue to promote and support change at all levels of transformation: of the curriculum, of science, and of work practices,"(Home Group L). Members cited some positive signs in this direction, including the increasing support for women in academic institutions, increasing numbers of women in technical fields and the growing realisation that for meaningful dialogue to occur in many areas, (such as agriculture in Africa), women had to be included. Other members were anxious that "the desire to share power and information and to be inclusive of all, must be balanced with a respect for the right of the indigenous individuals or cultures to assimilate and to share knowledge on their own terms," (Home Group C). Home Group W made similar points. They talked of the risk of 'high status' people being 'really democratic' and listening to 'low status' people They noted the need for women's own technology to be validated. Debate about the "ways in which paradigms of the western industrialised world concerning science and technology inform, or are informed by, the need and opportunity for non-industrialised countries to determine their own definitions and construct paradigms which are appropriate and enhancing for themselves, (Home Group B), was taken up by most groups following the Feminist Forum on Sunday evening."

The problem of the continuing existence of "invisible barriers" to equality related to differential privileges and power was also widely discussed in the groups. Particular note was made of the lack of women representatives in funding agencies for science. One group asked, "How can we ensure that funding agencies 'quick-fixes' of the gender and science "problem" are no reduced to the add-on simplistic level projects such as videos, more of the same old science centres, competitions and so on?" In this group's view, GASAT needed to develop a voice in promoting activities which were "more likely to effect long-term change," (Home Group L).

Similar discussion developed in other groups who argued the need for government policies to be linked with theoretical frameworks, i.e. feminist/educational/scientific and ways found to ensure that the theoretical frameworks adopted had practical application and relevance to classrooms. To achieve this, members felt GASAT needed help in drawing more explicitly on feminist theory. "The observed differences in understanding of feminist theory, could be taken-up as a learning potential for future conferences where we could seek some assistance/input from recognised international feminists," (Home Group L). Again, we were reminded about our use of language. The use of the word feminist and feminism is problematic in an international context. As Home Group C pointed out - the Indonesian translation of 'feminist,' means "women of loose morals."

The concern about access, moved the discussion on to focus on the nature of science and technology. "We have passed the stage of working to bring young women into science and technology, we need now to transform them, so that young women can flourish within them." Part of the answer to this problem, Home Group R saw, was "to get values back into science and technology, to integrate these areas with nature and philosophy, to include, as one member suggested - ethics, aesthetics and epistemology." Home Group S however, asked about the process by which this could be achieved. "How do we attempt to deconstruct and reconstruct? How do we merge the attempts at theoretical levels with the struggles at the practical levels? How do we join a call for the philosophers of science to be drawn into GASAT with the call for attention to be paid to the needs of women in agriculture - those who work in the soil, those who toil?"

In other groups there was disagreement about perceiving science as a social construct. Some members felt that "the principles are there and only applications change," (Home Group T). For another group, the deconstruction of science meant dismantling the class system and this they recognised would meet with very strong resistance. Gender sensitivity and equality in science and technology had to be seen as part of a broad social change that GASAT advocates. Home Group P (Lesley Parker), were concerned about the imbalance in power between males and females in science and technology. They also discussed the process by which women in science and technology could challenge the dominant male model. Some members indicated that, in the settings in which they personally operated, it would be counterproductive to use the term 'feminist'. Any challenges to male power would have to be projected as "sharing" of power and not "taking over". Most agreed that although there was a need to change the whole institutional/societal context to address the gender/power issues adequately, it was nevertheless possible for individuals to have an impact. They recommend the following:

- ensure a political commitment through exercising influence as a voter and lobbyist;
- change science wherever and whenever you can to make it more 'connected to people' and to life-affirmation;
- teach conflict resolution strategies to males and females at all levels of education;
- gain support from the media and from legislative procedures for these teachings.

These dilemmas about GASAT's purpose and future directions were shared by many members. For many the aims were clear but not the pathways. Home Group R's approach to these very large questions was both optimistic and realistic. "We

The following report was compiled from the notes taken at the training sessions which were facilitated by Sue Lewis. Before the conference started the Home Group facilitators met to increase their collective and individual confidence in the daunting task ahead of them and to plan the program options for the sessions.

PREPARATION FOR HOME GROUP FACILITATORS

WHY HOME GROUPS?

As facilitators one of the ways we prepared ourselves was to brainstorm the reasons for the Home Group organization of the conference. There were two groups of participants in this brainstorm: those who had attended the previous GASAT where the Home Groups had been introduced and those who were attending their first GASAT. Below are the edited outcomes of the two brainstorming groups - they are surprisingly similar in their perspectives and are a useful reminder to our "conference consciousness".

PEOPLE WHO ATTENDED GASAT 6 - some of whom were facilitators there:

- Home groups are a daily reminder of "need to go slow"
- Individuals "newest to GASAT" are welcomed into GASAT
- Home groups are a space to have an international perspective aired and challenged. Reduces the risk of dominant perspective taking over.
- Information disseminated effectively allows us to "attend more of the conference"
- Themes - each day: - good opportunity to talk in depth without preamble
- Helps equalise "high status" people
- Continued networking after the conference
- Reflective process - very rewarding to exchange views of sessions
- Potential to talk about forums/issues prior to them happening
- To give everyone an opportunity to speak
- Negotiating with home group members helps everyone belong to the decision making process at GASAT
- Instant knowledge of at least 12 people who have different interests
- Sort out peoples' problems early on
- Sharing and support, opportunity to operate in a feminist environment which is impossible in large masses
- Can create atmosphere of trust where frankness is possible
- People from different backgrounds and with different experiences can learn from each other

weren't afraid to ask the awkward questions, and we didn't pretend the answers were easy or even could be agreed upon. Rather, many questions were multi-layered, finding a solution at one level, left other un-resolved . . . GASAT has evolved to a turning point. The transformation of science and technology has been more clearly the focus and we must move on from there. The Darwinian view of evolution through competition and natural selection is not suited to our progress. Instead, cooperation and evaluation, using feminist ways of interpreting our position will help us move forward."

Many other points were made and debated in the Home Groups, including the controversial notion of a feminist pedagogy which many felt would benefit all who experienced it, but Léonie Rennie's words, written on behalf of Home Group R seem an appropriate way to end this overview. What is clear from Léonie's words and what has been distilled in this overview is that Home Groups play a vital role in enabling members to reflect on the processes that lie at the heart of GASAT. Apart from giving members the opportunity for close informal contact and support, they allow synthesis of ideas. The outcome of this synthesis indicates the way forward for GASAT if it is to achieve its aims of eliminating barriers to equality generally, and in science and technology specifically.

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PEOPLE WHO WERE AT THEIR FIRST GASAT CONFERENCE

- Small groups may defuse "grand standing"/power struggles
- Everyone has space to talk
- Sense of belonging and social contact
- Technique for building relationships
- Sharing of information regarding conference
- Discussion/consolidation/synthesis of key themes
- Comfortable space to discuss issues

PROBLEM-SOLVING

As facilitators, we also focused on strategies to increase our skills and hence make the experience of the Home Group more enjoyable for the participants. We identified some of the situations we all felt we could become more skilled at:

- How to co-operatively critique ideas without alienating.
- Dominance of the English speakers
- Quiet members
- Noisy members!
- Low energy in the group
- What to do if some members of the group don't want to participate in the Home Groups at all.
- A person who is difficult and always negative in their perspective

STRATEGIES TO TRY

Empathise. Share responsibility for discussion and process. Listen. Use people's names. Be aware of cultural differences. Synthesize peoples' ideas. Encourage active participation of all in the group. Mediate disagreements. Be a negotiator. Ensure everyone gets their share of speaking time. Generate a sense of fun - shared laughter. Read group members' contributions and ask questions. Be aware of people's background, field of work, interests at GASAT. Act on body language which is signalling discomfort.

We hope that the list of strategies we came up with worked!

THE CONTEXT OF THE CALL TO ACTION

The following *Call to Action* which was delivered at the end of the GASAT 7 conference summarizes the perspectives, initiatives and ideas which are at the forefront of world-wide activity in the area of gender and science and technology and which formed the contributions and deliberations of GASAT 7. (See *Transforming Science and Technology: Our Future Depends on it*, Volumes 1 and 2, Contributions to the seventh International Gender and Science and Technology Conference, Toronto, May 1993. ISBN 0-7778-1257-6 and ISBN 0-7778-1258-4)

Dr Karen Messing was charged with the formidable task of delivering a summary talk at the end of the GASAT 7 Conference which would bring together the deliberations and reflections of the 250 delegates from 25 different countries. The talk was to capture the discussions about the issues and the presentations at the conference as well as to provide recommendations based on those discussions.

Karen was assisted in this task by the Home Group process. These groups were comprised of small numbers of participants, from diverse backgrounds, who met daily to explore and synthesise issues raised at the Conference. The facilitators who coordinated the activities of the Home Groups fed back the groups' discussions and key issues to Karen.

The *Call to Action* was also circulated to funders, policy makers and other change agents who are in a position to act upon the recommendations. The recommendations are boxed as they appear in the text for easy reference and suggested implementers are given. **We encourage the reader to take action on the recommendations and to bring then to the attention of key policy and decision makers.**

CALL TO ACTION

Karen Messing
Centre pour l'étude des interactions biologiques entre la santé et l'environnement
Université du Québec à Montréal

PREAMBLE

I want to start with a bid for sympathy. There have been 12 sessions at this conference, and each of them has contained at least five different sets of presentations. Simple mathematics tells us that there are millions of different experiences that we can have had at this conference. I have only had one of them. In addition, I have come to my experience with my North American background and point of view. So I can't possibly come out with a summary of everyone's experience at the conference.[1] I have therefore decided that I can only tell you what I got out of the conference. I will present some concrete solutions proposed by the participants, together with some indications about who could implement these proposals. Of course, the context and political situation of the particular country will condition the exact ways in which these proposals will be implemented.

INTRODUCTION

It has been extremely exciting to be at this conference. I have never attended a meeting where participants from so many countries were so well integrated into the activities. I have never, never been at a scientific conference where I was so comfortable with my fellow attendees. Of course (to borrow an expression from Ann Holmes) it was not perfect, it was very very good.

It will be wonderful to have the opportunity, during the next conference in India, to include more women with applied technology backgrounds.[2] Women who work in agriculture, in fabric arts, in pottery, those who have developed technologies which respect their environment, those who have had to cope with the difficulties of gaining the scientific and technical information necessary to protect women's health, will be able to give us guidance in how to make science and technology available to all women.

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[1] A list of the main issues not taken up here is included as an appendix.

[2] Suggested implementers: GASAT committee for the next conference.

SOME OF THE MAIN POINTS OF THE CONFERENCE

Reminders of some things we knew

The conference has been a place to reaffirm some sad truths. Although women are advancing, with the help of an enormous variety of programmes and initiatives, progress has not been in proportion to the effort that has been expended and the personal costs to the women at this conference, who have often suffered insults, embarrassment and financial loss in their struggles for survival in science and technology professions and in their efforts to hire and retain women scientific and technical personnel.

Several people have suggested that, because the GASAT conference is taking place in Canada, I recall the assassination of the 14 women in engineering on December 6, 1989 in Montréal. Unfortunately, it was not an isolated episode of violence. Psychological and even physical violence has often been our only reward, and it has been comforting to me to share some of my experiences and hear others. Healing ourselves after these episodes is a long and hard process, and gatherings like this give us the energy to keep on.

This is an important point which has come up again and again. Women need times and spaces to be together and share their experiences. Whether they be formal meetings, committees or caucuses within larger organizations or just places to meet informally, such facilities must be provided wherever women are engaged in activities where they have not been welcomed.

More specifically, in engineering schools, in science programmes, in unions, in workplaces and in community organizations, every attempt must be made to provide women with space and time to be together and share their experiences. In some cases where the implications have been fully thought out, women-only courses, committees or programmes may be important bridges for women entering science and technology activities.

Re-examining our strategies

Initially, we thought we could just use propaganda to tell young women to enter scientific and technical professions and the problem of an unfriendly environment would solve itself with increasing numbers of women. We are now sadder and wiser.

If it were easy and automatic for women to be integrated into these professions they would already be there. More energetic strategies are required. Experimental strategies are being developed in many countries. I have not sufficient time to summarize the dozens of exciting initiatives, but they may take the following forms:

In education and training

1. Reducing the distance between the average woman's experience and the content being taught. These experiments include incorporating material familiar to women or which women find relevant, including ethical questions.

For women, putting the technical and scientific information into a human context is of prime importance.[3]

2. **Reducing the distance between the average woman's way of doing things and the form in which information is transferred.** These experiments include concrete, hands-on projects, a comfortable, non-competitive environment, respect for the animals we study, freedom to ask questions and gender-fair assessment procedures. It is very helpful to have women from the group being taught as the teachers or project leaders: rural women to train rural women, for example. Several research results presented at the conference point out that these techniques, although risky and sometimes costly, facilitate learning by both males and females.

Developing low-budget methods for making a classroom or training environment friendly to women is an important priority not only for developing countries, but for other countries facing budgetary constraints.[4]

However, this should not be done by exploiting women's labour.

In the workplace

We are now discovering that it is not enough to make women change. All the assertiveness training in the world will not solve the problems of the first woman mechanic in an all-male machine shop. **Presenters have described new attempts to make key men in power positions such as executives, vocational trainers and foremen more sensitive to gender issues, by explaining to them and by confronting them with**

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[3] Suggested implementers: School systems, educational researchers, educational project officers.

[4] Suggested implementers: Research granting agencies, international cooperation agencies, researchers.

women's reactions.[5] **We are only at the beginning of these important projects.**

More and more, we will have to think about how to change the ways the two sexes relate to each other in the workplace and support those men "of good will" who can be critical agents for change.

A lot of discussions have taken place around mentoring, which I cannot present fully here. Many different models have been presented, most of which involve women in positions of power who coach more junior women.

Informal mentoring has been a route to power for men in the workplace, but we still do not know whether it is a good route for women. Formal mentoring schemes have been introduced, but their success has been questioned. They may force senior women, already overloaded, to take on extra work. Some mentors may be more helpful than others.

At its best, mentoring is be an important source of encouragement and support for young women, who can learn the unwritten rules of organizations. But we have questioned whether such an emphasis on individual learning is sufficient to make organizations better places to work.

Mentoring schemes should be supplemented by meetings of women at the same level of hierarchy, so that they can discuss common problems and push for organizational change.[6]

Women need such forums, in which they can express their needs for mechanisms to cope with family and professional responsibilities: maternity and parental leave, day care, eldercare, care for sick children.

Studies of the reasons for attrition in science and technology professions should be done to assess the importance of such programmes in maintaining women in the workplace.[7]

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[5] Suggested implementers: employers, educational projects, unions, school systems, universities, governments.

[6] Suggested implementers: employers (including government), unions, student associations, schools, educational projects, universities.

[7] Similar research should be done to assess the importance of these factors in attrition during education and training.

CHANGING SCIENCE AND TECHNOLOGY

Many presenters have called for changes in the nature of science and technology. We have heard from many presenters that they are not happy with the way scientific and technical institutions have developed, usually in relation to the needs of very small segments of the population. In my introductory talk, I gave examples of androcentric science and technology. During the conference, I have heard about others, such as the practices of medical certification of virginity in Turkey. In Canada, we are quite familiar with the debates around women-centred technology due to the controversies surrounding reproductive technologies.

We therefore call for development of gender-inclusive science and technology, through support of new initiatives in research and development. National and international granting agencies should develop guidelines for non-sexist research[8] and see that specific members of peer review committees are mandated to oversee their application.

People at the conference are not only worried about the inclusion of women's needs and priorities in defining scientific institutions. They are also questioning the very nature of those institutions. They deplore the artificial limits which recognize only some scientific and technical activities and not others. They don't understand why trying out different drugs to see what works for a cancer patient is science and trying out different foods to see what works for a baby's digestion is not. I study hospital cleaners, and I don't know why people laugh when they are called sanitation technicians: they juggle dozens of chemicals in their work and have to figure out the best equipment and tools to confront a tremendous number of new situations.

Many people have important knowledge which can be useful in advancing the frontiers of science and technology, and it is now being wasted.

We therefore call for recognition of science and technology developed by people outside the science and technology institutions. This recognition is necessary in courses, museums and training programmes, and requires efficient use of "informers" from outside the science and technology professions, including teachers, rural women, housewives, students, community activists, workers, farmers, and craftspeople.

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[8] In Canada, only the Social Sciences and Humanities Research Council has such guidelines.

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We therefore call for recognition of science and technology developed by people outside the science and technology institutions. This recognition is necessary in courses, museums and training programmes, and requires efficient use of "informers" from outside the science and technology professions, including teachers, rural women, housewives, students, community activists, workers, farmers, and craftspeople.

So there is an important communication problem between "ordinary people" and people officially recognized as experts. Both groups have knowledge and ideas from which the other could profit, but present-day unidirectional techniques for producing and transferring knowledge prevent us from working together effectively.

Structures should be set up by universities, governments, granting agencies, international cooperation agencies to make sure that groups affected by research are implicated as partners, with structures which can guarantee an equality in the partnership. These structures should guarantee that the inputs of both parties are respected, and contain provisions for protection of the credibility of both parties.

This is not an easy task. A number of people have come to me during the conference and asked me how it is that our research group has succeeded to some extent in developing an original, gender-inclusive research programme, and why it is that we have come to identify so clearly some of the structural obstacles to inclusion of women's concerns. At the risk of taking undue advantage of my privileged position at the end of the conference, I would like briefly to present some of the structures without which we could not have developed our program: 1) Agreements between our university and community organizations; 2) Granting agencies or programmes which include representation from the groups being studied.

Agreements between the university and the community organizations

The Université du Québec à Montréal has signed three formal agreements with community groups, one with a consortium of women's groups "Relai-femmes," one with two of the three major Québec unions, the CSN[9] the FTQ[10] and one with the third union, the CEQ.[11] These agreements provide that the university will supply resources for teaching and research, in response to requests from the community group. On request, university professors can teach 45 hours in a community setting and be released from 45 hours of university teaching. They can do research on projects requested by the community group and some resources are provided by the university.

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[9] Confédération des syndicats nationaux, a Québec union with 200,000 members, about half of whom are women.

In most cases, the educational and research programmes go through normal university channels. Course content is approved in the usual way, and small amounts of research seed money is provided by the internal grants committee. Further funding if necessary must be obtained from outside granting agencies.[12] These agreements have given us the opportunity to participate in courses on women's biology at the local women's health centre, union-organized workshops on work and health, to produce information on noise, radiation and solvents and to work with the unions' women's committees to write brochures on protection of pregnant women, women's occupational health, and health risks for women in non-traditional jobs. Other professors have written women's histories, provided aid for women's literacy programmes or given information on reproductive technologies.

These agreements provide guarantees for both groups and professors. The researcher retains full title to the research results, but must report them to the group. Ongoing frameworks for the projects are provided by joint committees, which guarantees that the original objectives are maintained. Several employees are assigned full-time as coordinators of the projects, with the task of balancing researchers' and community needs.

Our work is carried on within the context of our union's collective agreement. This

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[10] Fédération des travailleuses et travailleurs du Québec, a Québec union with 350,000 members, about 30% of whom are women.

[11] The Centrale de l'enseignement du Québec (CEQ) groups all of Québec's primary and secondary school teachers, as well as some junior college and university lectureres and professors and some support staff. It has a large majority of women members.

[12] Comité conjoint UQAM-CSN-FTQ, 1977. Le protocole d'entente UQAM-CSN-FTQ: sur la formation syndicale. Services à la collectivité, Université du Québec à Montréal, CP 8888, Succ. A, Montréal, Québec H3C 3P8.

Comité conjoint UQAM-CSN-FTQ, 1988. Le protocole UQAM-CSN-FTQ: 1976-1986. Bilan et perspectives. 36 pages. Services à la collectivité, Université du Québec à Montréal, CP 8888, Succ. A, Montréal, Québec H3C 3P8. 1988.

Karen Messing 'Putting our two heads together: A mainly women's research group looks at women's occupational health' in Wine J. and Ristock J. Feminist Activism in Canada: Bridging Academe and the Community (Toronto: James Lorrimer Press 1991). Reprinted in National Women's Studies Association Journal 3:355-67.

means that the groups have access to regular professors rather than ad-hoc services. The groups benefit from the perquisites of professors' status, such as access to university services and grants. Community-initiated research, which is sometimes received with hostility by the scientific community, must be recognized by our employer, at the risk of grievance procedures in the context of our collective agreement.

The work we have done in this context has been extremely exciting, and has, incidentally, brought about $500,000 a year into the university in the form of outside grants. With working women, we have been able to come to a better understanding of their needs, and provide some information which has been helpful to them. Their solidarity has been a source of strength to us over many years, and their insights have been invaluable. From the cleaner who explained to us why "light work" was heavier than "heavy work" to the technicians who told us why time-and-motion studies were not a good way to organize radiotherapy treatments to the factory workers who made us understand why being able to go to the bathroom when you need to is an important health practice,[13] workers have constantly put us in touch with the reality of occupational health problems. If our colleagues had similar opportunities and information, perhaps they would help change the rules for occupational health research. Talking to workers might make them able to believe in their accounts of risks and symptoms, and make them feel as we do that it is important that their health be protected.

Granting agencies with community input

We have been supported by two Québec granting agencies which incorporate representatives from labour or community groups in the determination of funding. The Québec Institute for Research in Occupational Health and Safety incorporates representatives from labour and management explicitly into determination of grants; the two sides explicitly and openly negotiate to fund research that they consider important. This process paradoxically appears to allow for less research bias in funding since the practical consequences of the projects are put on the table from the outset. The Québec Council for Social Research incorporates community representatives in its decision-making processes. They are currently funding one of our studies on of the impacts and consequences of methods used to balance family and professional responsibility, a study initiated by the FTQ union.

The Canadian government also has a grants programme in the social sciences which involves input from women's groups. As biologists, we would not ordinarily be eligible for these funds, but because of our strong community involvement we (and others in the occupational health field) have been well supported. In fact, a much larger proportion of research in women's occupational health in Canada has been supported in social sciences than in health science granting agencies.

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[13] Doctors testified otherwise, but the workers won their case.

Of course, our model is not the only one. Educational researchers may want to make other kinds of agreements to include teachers and students in gender-sensitive teaching,[14] First Nations' people will think of ways to set up communication between traditional and outside health practitioners, rural people may want to develop other ways of getting in touch with civil engineers. International agencies will need to develop their own mechanisms for guaranteeing community input. But I would like to emphasize the critical features of our model:

Explicit recognition of the power imbalance between career researchers and community groups, with structures in place to guarantee that the needs of both are recognized throughout the entire project.
Guarantees of scientific credibility through some form of peer review. Although peer review committees need to be sensitized to the specific difficulties of community-based research, they provide an important quality guarantee to the community group and help maintain the scientific credibility of the researchers.
Title to the research results held by the researcher. This is an important incentive for the researchers, balanced by their responsibility to deliver results to their collaborators.
Money available in two stages: seed money for feasibility studies, often necessary with the radically-new questions posed by community groups; more substantial amounts from agencies which include community members in the review process.

We seem to be rather far from the first GASAT meetings. Why is community-based research an issue of gender in science and technology? In answer, I want to refer to the opening talk, when I tried to show that the integration of women's concerns in science and technology is a question of sharing power. Without structures which give women and other disadvantaged groups real power in determining the course of science and technology, we will never transform these institutions. And, as we have seen over the last five days, the kinds of exciting initiatives women have been developing constitute the future of science and technology.

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[14] The McClintock collective is a model for action research in collaboration with students and teachers.

APPENDIX
OTHER ISSUES RAISED BY PARTICIPANTS

Strategies for change

Data collection (suggested implementers: government agencies, researchers)
Data should be collected in such a way that full analysis is possible, combining data on class, sex, ethnicity and other important parameters of equity.

One example of the social context of technology is the inadequacy of data collection even in countries with well-developed information technology. Getting adequate information on women's participation in science and technology is an important prerequisite for action. Then this information can be used as a basis for action.

Family responsibilities (suggested implementers: employers)
The fact that academic and other workplaces have been organized in relation to a single possible lifestyle is an important obstacle to full integration of women.

In many countries, inadequate provisions for maternity leave, child care, eldercare, caring for sick children, and multiple tasks impede women's progress, while inadequate provisions for paternity leave and reconciliation of roles impede women's and men's equal participation in the family. Students and part-time workers are often in a particularly disadvantaged position.

Support structures (suggested implementers: employers)
Since academic or workplace credibility may suffer when one is identified with feminist concerns, support structures should be created and used.

There should be spaces and times where women can get together.

Women-based technology (suggested implementers: health care systems)
It is important to think about the social context of some technologies developed in order to empower women, particularly around reproduction.

The example given at the conference was the operations done by doctors to restore virginity, which incease the freedom of action of individual women while not questioning the assumptions of the patriarchal system. This is a situation where interim strategies may be folowed by individuals in order to protect themselves while doing political action. Consider needs of women both immediate and long-term.

Collaborative structures (suggested implementers: research agencies, universities, school systems, governments, international collaboration organizations, researchers)
There should be collaborative structures set up so that teachers and students can be involved in socially responsible gender-inclusive science and technology as active collaborators.

How to get pressure for gender-inclusive science and technology going in a new region (suggested implementers: women and governments in developing countries)
Pressure should come from a network of women with strong alliances among themselves. Collaboration must be developed with the political authorities; if they are not receptive to start with, the attempts will fail. The emphasis should be on re-defining scientific and technological institutions at the same time as girls and women are integrated. Events such as large conferences are helpful in getting started.

These efforts may be initiated by an individual or a single organization, but should become a community exercise. Interested individuals and groups should be drawn together. Activities aimed at mothers and daughters, big and little sisters should be considered.

Teaching and training

Science literacy (sugested implementers: all involved with education)
Both in developed and developing countries, the notion of universal literacy should be extended to include scientific literacy, the acquisition of a minimal level of understanding of the scientific process, of mathematical tools and of the physical world.

Defining feminist pedagogy (suggested implementers: researchers)
Feminist pedagogy as usually defined includes two components: styles of teaching which are collaborative and inclusive, and content of teaching which includes issues concerning gender and power.

Many people object to the term "feminist" to describe their initiatives. The issue of whether or not to call ourselves feminists is still undecided; there is no consensus among GASAT members.

Decreasing the distance between women's experience and science and technology (suggested implementers: teachers and researchers)
It is important to recognize and incorporate into teaching the science and technology components of women's everyday experiences, while challenging sex-stereotyping and the segregated workplace. This may threaten hierarchical and class relationships.

It is important to develop techniques which can be used in large classes, since budgets are very low in some countries and falling in most countries.

Using teachers as close as possible to the student population in terms of background and interests (suggested implementers: educational projects)
It is important for teachers to understand where students are coming from. When working with adult or new populations, it is desirable to train educators from among the student population.

For example, training rural women to teach other rural women. Selection of these educators is not easy.

Single-sex classrooms (suggested implementers: educational projects)
In some situations it is important for girls and women to learn in the absence of boys or men. Experiences with this are often positive. It is important that the reasons for setting up these situations be presented to the students.

Assessment (suggested implementers: school systems, universities, teachers and researchers)
Styles of evaluation of students should be gender-fair. Questions should include a variety of types and should be relevant to human experience, portraying males and females in their social and environmental contexts.

Cooperation and collaboration (suggested implementers: school systems and universities)
Pedagogical techniques which emphasize extreme competitiveness should be discouraged.

Ethics (suggested implementers: schools, universities, teachers and researchers)
Ethical questions should be part of the context of teaching science, and be taught as part of decision-making.

Unnecessary cruelty to animals is present in some biology courses. This alienates many young women. In some courses in some countries, videos, computer simulations, or models can replace live animals. When this is not possible respect for animals and humaneness should be part of teaching.

Media (suggested implementers: science writers' associations, continuing education)
Workshops should be developed for science writers which would help them report on women and science.

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LE CONTEXTE DE L'APPEL À L'ACTION

L'Appel à l'action suivant, qui a été présenté à la conférence GASAT 7, résume les opinions, initiatives et suggestions au premier plan de l'activité mondiale dans le domaine de l'équité des sexes en sciences et en technologie, qui ont été à la base des soumissions et délibérations de la GASAT 7. (Voir *Transformer les sciences et la technologie : notre avenir en dépend*, volumes 1 et 2, Les soumissions à la septième conférence internationale sur l'équité des sexes en sciences et en technologie, Toronto, mai 1993. ISBN 0-7778-1257-6 et ISBN 0-7778-1258-4).

Dr Karen Messing a été chargée de l'énorme tâche de présenter, à la septième conférence GASAT, un sommaire des délibérations et réflections des 250 déléguées des 25 pays représentés. Cette tâche visait à récapituler les discussions sur les questions et présentations de la conférence, ainsi qu'à fournir des recommandations sur la base de ces discussions.

Karen a été assistée dans sa tâche par de petits groupes locaux composés de participantes et participants aux antécédents divers, qui se sont rencontrées quotidiennement pour explorer et mettre en rapport les questions soulevées dans le cadre de la conférence. Les animatrices qui ont coordonné les activités de ces groupes ont fait rapport des discussions et questions clés soulevées à Karen.

L'Appel à l'action est également distribué aux pourvoyeurs de fonds, preneurs de décisions et autres agents de changement qui ont le pouvoir de mettre ces recommandations en oeuvre. Pour mieux les repérer, nous avons encadré les recommandations dans le texte et les avons suivies du nom des exécutrices et exécuteurs proposés. **Nous encourageons les lectrices et les lecteurs à agir sur la base de ces recommandations et à les communiquer aux personnes clés responsables de prendre les décisions et d'élaborer les politiques.**

APPEL À L'ACTION

Karen Messing
Centre pour l'étude des interactions biologiques entre la santé et l'environnement
Université du Québec à Montréal

PRÉAMBULE

Permettez-moi tout d'aboard de faire appel à votre compréhension. Cette conférence a englobé 12 séances, chacune avec au moins de 5 présentations différentes. Après quelques calculs de base, on s'aperçoit rapidement que nous avons pu vivre des millions d'expériences différentes dans le cadre de cette conférence. Moi, je n'en ai eu qu'une. En outre, cette expérience, je l'ai vécue compte tenu de mes antécédents et de mon point de vue nord-américain. C'est pourquoi vous comprendrez qu'il m'est impossible de vous présenter un résumé des expériences de toutes les personnes qui ont participé à la conférence.[1] J'en ai donc déduit que je ne pourrais vous parler de la conférence que d'après ce que j'en ai retiré personnellement. Je vous présenterai certaines des solutions concrètes proposées par les participantes et participants, ainsi que des suggestions quant à qui pourraient mettre en oeuvre de telles solutions. Bien entendu, le contexte et la situation politique d'un pays particulier détermineront les façons précises dont ces propositions seront mises en oeuvre.

INTRODUCTION

Cette conférence m'a beaucoup passionnée. C'est la première fois que j'assistais à une réunion où des gens de tant de nationalités différentes parvenaient si bien à s'intégrer aux activités. Je n'ai jamais, et je dis bien jamais, assisté à une conférence scientifique où je pouvais si librement et si confortablement discuter avec les autres personnes présentes. Bien entendu (pour reprendre une expression de Ann Holmes), ce n'était pas parfait, c'était très très bien.

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[1] Une liste des principales questions qui ne sont pas soulevées ici figure à l'annexe.

Ce sera formidable de pouvoir, à l'occasion de la prochaine conférence, en Inde, inclure plus de femmes qui possèdent de l'expérience en technologie appliquée.[2] Les femmes qui travaillent dans les domaines de l'agriculture, des arts du tissu et de la poterie, celles qui ont mis au point des technologies qui tiennent compte de leur environnement, et celles qui ont dû faire face aux difficultés d'acquérir les connaissances scientifiques et techniques nécessaires pour protéger la santé des femmes pourront nous guider sur la façon de rendre les sciences et la technologie accessibles à toutes les femmes.

FAITS SAILLANTS DE LA CONFÉRENCE

Rappel de certaines choses que l'on savait...

La conférence nous a permis de réaffirmer quelques vérités fort tristes. Malgré les progrès remarquables accomplis par les femmes, dus en grande partie à la quantité énorme de programmes et initiatives mis sur pied, ils n'ont pas été proportionnels aux efforts déployés et à ce qu'ont déjà dû endurer les femmes qui ont participé à cette conférence, en insultes, embarras et pertes financières pour survivre dans les professions des sciences et de la technologie et faire en sorte d'embaucher et de conserver des femmes dans leur personnel scientifique et technique.

Étant donné que la conférence GASAT avait lieu au Canada, plusieurs personnes ont suggéré que je parle de l'assassinat de ces 14 femmes en génie, le 6 décembre 1989, à Montréal. Malheureusement, cette épisode de violence n'est pas un cas isolé. La violence psychologique et même physique a souvent constitué notre seule récompense et ça m'a beaucoup réconfortée de partager certaines de mes expériences et d'en écouter d'autres. Le processus de guérison qui suit de tels épisodes de violence est long et difficile et ce sont des réunions comme celle-la qui nous donnent de l'énergie à continuer.

C'est un point important que l'on soulève à maintes reprises. Les femmes ont besoin de temps et d'espaces pour se rencontrer et partager leurs expériences. Que ce soit dans le cadre de réunions formelles, comités ou réunions à l'intérieur de plus grandes organisations, ou des endroits où se rencontrer juste pour discuter, de telles installations doivent être mises à la disposition des femmes, partout là où elles participent à des activités où depuis toujours elles n'ont jamais été les bienvenues.

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[2] Exécuteurs proposés : comité GASAT pour la prochaine conférence

Plus spécifiquement, dans les écoles de génie, dans les programmes de sciences, dans les syndicats, dans les milieux de travail et dans les organismes communautaires, chaque effort possible doit être déployé pour procurer aux femmes l'espace et le temps nécessaires pour se réunir et partager leurs expériences. Dans certains cas, où les répercussions ont été soigneusement soupesées, des cours, comités ou programmes réservés aux femmes peuvent représenter d'importants moyens de transition pour les femmes qui décident d'entrer dans des activités scientifiques et techniques.

Réexamen de nos stratégies

Autrefois, nous pensions qu'il suffisait de faire de la propagande pour encourager les jeunes femmes à entrer dans les professions techniques et scientifiques, et que le problème d'un environnement hostile se résoudrait de lui-même au fur et à mesure qu'il y aurait plus de femmes dans ces professions. Nous sommes aujourd'hui plus tristes mais plus sages.
Si l'entrée dans ces professions était simple et automatique pour les femmes, elles y seraient déjà. Des stratégies plus énergiques sont nécessaires. Diverses stratégies sont déjà mises à l'essai dans de nombreux pays. Je n'ai pas vraiment le temps de vous parler des douzaines d'initiatives excitantes mises en oeuvre, mais sachez qu'elles peuvent prendre les formes suivantes :

En éducation et en formation

1. Réduction de l'écart entre le vécu de la femme moyenne et le contenu de l'enseignement. Ces expériences incluent l'incorporation de matériel familier ou pertinent pour les femmes, y compris des questions d'éthique.

Pour les femmes, il est absolument essentiel de mettre les renseignements techniques et scientifiques qu'on leur donne dans un contexte humain.[3]

2. Réduction de l'écart entre la façon de faire les choses de la femme moyenne et la façon de transmettre l'information. Ces expériences incluent des projets concrets, pratiques, un milieu confortable, non compétitif, le respect des animaux étudiés, la liberté de poser des questions et des méthodes d'évaluation équitables. Il

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[3] Exécuteurs proposés : systèmes scolaires, chercheuses et chercheurs en éducation, agentes et agents de projets d'éducation.

est utile de demander à des femmes du groupe, à qui l'on enseigne, de prendre le rôle d'enseignantes ou de chefs de projet : des femmes des régions rurales pourraient, par exemple, former d'autres femmes des régions rurales. Plusieurs résultats des études qui ont été présentées à la conférence démontrent que ces techniques, bien que risquées et parfois coûteuses, facilitent l'apprentissage tant chez les hommes que chez les femmes.

La mise sur pied de méthodes peu coûteuses visant à rendre une salle de classe ou un environnement de formation accueillant pour les femmes est une priorité importante non seulement pour les pays en voie de développement, mais aussi pour les autres pays confrontés à des restrictions budgétaires.[4]

Toutefois, ceci ne devrait pas se faire en exploitant le travail des femmes.

Dans le milieu du travail

Nous découvrons qu'il ne suffit pas de demander aux femmes de changer. Tous les cours d'affirmation de soi au monde ne peuvent résoudre les problèmes de la première mécanicienne qui entre dans un atelier de mécanique. **Les présentatrices et présentateurs ont décrit de nouvelles tentatives visant à rendre les hommes qui détiennent des postes clés, tels que les cadres, les responsables de la formation professionnelle et les contremaîtres, plus sensibles aux questions d'égalité entre les sexes, en leur expliquant et en les confrontant aux réactions des femmes.**[5] Nous n'en sommes qu'aux premières étapes de ces projets importants.

De plus en plus, nous devons songer à modifier les façons dont les deux sexes se situent l'un par rapport à l'autre dans les milieux de travail, et encourager les hommes <<de bonne foi>> qui sont en mesure de contribuer au changement à agir.

Nous avons beaucoup parlé de "mentoring." Je ne peux malheureusement pas m'attarder trop longuement sur ce sujet ici. Un grand nombre de modèles différents

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[4] Exécuteurs proposés: organismes subventionnaires de la recherche, organismes de coopération internationale, chercheures et chercheurs.

[5] Exécuteurs proposés : employeuses et employeurs, projets d'éducation, syndicats, systèmes scolaires, universités, gouvernements.

ont été présentés, la plupart d'entre eux impliquant des femmes à des postes d'autorité, qui conseillent les femmes plus jeunes.
Le "mentoring" a toujours constitué un chemin vers le pouvoir pour les hommes dans les milieux de travail, mais nous ne savons toujours pas si ce chemin est approprié pour les femmes. Des programmes de "mentoring" ont été mis sur pied, mais leur succès est douteux. De tels programmes risquent de pousser les femmes qui occupent des postes supérieurs, déjà surchargées de travail, à assumer encore plus de responsabilités. Certains mentors sont plus utiles que d'autres.
À son meilleur, le "mentoring" est une importante source d'encouragement et de soutien pour les jeunes femmes, qui peuvent ainsi apprendre les règles non dites des organisations. Toutefois, nous nous sommes demandées si un tel accent sur l'apprentissage individuel suffirait à améliorer les milieux de travail.

Les programmes d'encadrement devraient être accompagnés de réunions de femmes d'un même niveau de la hiérarchie, où elles pourraient parler de problèmes communs et promouvoir les changements au sein de l'organisation.[6]

Les femmes ont besoin de tels forums. Ils leur permettent d'exprimer leurs besoins de programmes visant à les aider à concilier leurs responsabilités familiales et professionnelles : congés de maternité et de paternité, garde d'enfants, soins aux personnes âgées, soins aux enfants malades.

Des études sur les raisons de l'attrition dans les professions scientifiques et techniques devraient être effectuées pour évaluer l'importance de tels programmes pour que les femmes puissent demeurer au travail.[7]

CHANGER LES SCIENCES ET LA TECHNOLOGIE

De nombreuses présentatrices et présentateurs ont suggéré d'apporter des modifications dans la nature des sciences et de la technologie. Beaucoup d'entre elles et d'entre eux ont fait connaître leur mécontentement à l'égard de l'évolution des institutions scientifiques et techniques, habituellement en rapport avec les besoins de très petits segments de la population. Dans mon discours d'ouverture, j'ai donné quelques exemples de sciences et technologie androcentriques. Pendant la conférence, j'en ai recueilli d'autres, comme la pratique de la certification médicale de virginité en Turquie. Au Canada, nous sommes relativement familiers avec les débats sur la technologie axée sur les femmes due à la controverse entourant les techniques de reproduction.

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[6] Exécuteurs proposés : employeurs (y compris le gouvernement), syndicats, associations étudiantes, écoles, projets d'éducation, universités.

[7] Des études semblables devraient être effectuées en vue d'établir l'importance de ces facteurs dans l'attrition en éducation et dans la formation.

Nous demandons par conséquent que des mesures soient prises pour faire des sciences et de la technologie un milieu qui incluent les perspectives des femmes, en soutenant les nouvelles initiatives en matière de recherche et de développement. Les organismes subventionnaires nationaux et internationaux devraient mettre au point des directives pour la recherche non sexiste[8] et faire en sorte que les membres des comités d'évaluation des pairs soient responsables de leur mise en application.

Les personnes qui ont participé à la conférence se soucient non seulement d'inclure les besoins et priorités des femmes dans la définition des institutions scientifiques, mais remettent également en question la nature de ces institutions. Elles déplorent les limites artificielles qui reconnaissent certaines activités scientifiques et techniques et pas de d'autres. Elles ne comprennent pas pourquoi le fait d'essayer différents médicaments pour voir lequel convient à un patient atteint du cancer est considéré comme une science alors que le fait d'essayer différents aliments pour voir lequel convient le mieux à la digestion de bébé ne l'est pas. J'étudie actuellement les nettoyeurs d'hôpitaux et je me demande toujours pourquoi les gens sourient quand on les appelle des techniciens du nettoiement. Après tout, ils travaillent avec des douzaines de produits chimiques et doivent rechercher les meilleurs équipement et outils possibles pour faire face à un nombre énorme de situations nouvelles.
De nombreuses personnes possèdent des connaissances passées qui pourraient nous aider à faire avancer les limites des sciences et de la technologie. Toutefois, de telles connaissances sont fréquemment gaspillées.

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[8] Au Canada, seul le Conseil de recherches en sciences humaines a émis à de telles directives.

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Nous demandons par conséquent que les sciences et la technologie développées par des individus à l'extérieur des institutions scientifiques et techniques soient reconnues. Cette reconnaissance est essentielle dans les cours, les musées et les programmes de formation, et exige l'utilisation efficace «d'informateurs» de l'extérieur des professions scientifiques et techniques, dont le personnel enseignant, les femmes des régions rurales, les femmes au foyer, les étudiantes et étudiants, les activistes communautaires, les travailleuses et travailleurs, les fermières et fermiers, et les artisanes et artisans.

Il existe un énorme problème de communication entre «les gens ordinaires» et les gens que l'on appelle des experts. Chacun de ces deux groupes possèdent des connaissances et des idées dont l'autre pourrait bénéficier. Toutefois, les techniques unidirectionnelles actuelles de production et de transmission des connaissances nous empêchent de travailler efficacement ensemble.

Des structures devraient être établies par les universités, les gouvernements, les organismes subventionnaires et les agences de coopération internationale pour s'assurer que tous les groupes touchés par la recherche deviennent des partenaires égaux. De telles structures devraient garantir que les points de vue des deux parties sont respectés et contenir des dispositions visant à protéger la crédibilité des deux parties.

Cette tâche est loin d'être facile. Un certain nombre de personnes sont venues me voir pendant la conférence et m'ont demandé comment notre groupe de recherche avait réussi, dans une certaine mesure, à développer un programme de recherche original, tenant compte de la perspective des femmes et comment nous étions parvenues à définir si clairement certains des obstacles structurels à l'inclusion des préoccupations des femmes. Au risque de profiter indûment de ma position privilégiée à la fin de la conférence, je tiens à vous présenter brièvement certaines des structures sans lesquelles nous n'aurions pas pu mettre notre programme sur pied soit : 1) Protocoles d'entente entre l'université et les organismes communautaires; 2) Organismes subventionnaires ou programmes qui incluent la représentation des groupes à l'étude; 3) Féministes et travailleuses/travailleurs solidaires.

Protocoles d'entente entre l'université et les organismes communautaires

L'Université du Québec à Montréal a signé trois protocoles d'entente formels avec des groupes communautaires, le premier avec un consortium de groupes de femmes, «Relais-femmes», le deuxième avec deux des trois principaux syndicats québécois, la CSN[9] et la FTQ[10] et le dernier avec le troisième syndicat, la CEQ[11]. Ces protocoles d'entente stipulent que l'université fournisse les ressources nécessaires pour l'enseignement et la recherche à la demande du groupe communautaire. Sur demande, les professeures et les professeurs de l'université peuvent enseigner 45 heures dans un cadre communautaire et être déchargés de 45 heures d'enseignement à l'université. Ils peuvent faire de la recherche sur des projets requis par le groupe communautaire, avec certaines ressources fournies par l'université.

Dans la plupart des cas, les programmes d'éducation et de recherche passent par les voies universitaires normales. Le contenu du cours est approuvé de la façon habituelle et de petites subventions de démarrage sont accordés par le comité des subventions interne. Les fonds supplémentaires nécessaires, le cas échéant, sont obtenus auprès d'organismes subventionnaires extérieurs.[12] Ces protocoles d'entente nous ont donné l'occasion de participer à des cours sur la biologie féminine au Centre de santé des femmes, à des ateliers organisés par des syndicats sur la santé au travail, de donner des renseignements sur le bruit, les radiations et les solvants et à collaborer avec les comités féminins des syndicats pour rédiger des brochures sur la protection des femmes enceintes, la santé des femmes au travail et les risques pour la santé des femmes qui occupent des postes non traditionnels.

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[9] Confédération des syndicats nationaux, un syndicat québécois comptant 200 000 membres, dont près de la moitié sont des femmes.

[10] Fédération des travailleuses et travailleurs du Québec, un syndicat québécois comptant 350 000 membres, dont environ 30 % sont des femmes.

[11] La Centrale de l'enseignement du Québec (CEQ) regroupe tout le corps enseignant des écoles primaires et secondaires du Québec, ainsi que les chargées et chargés de cours, professeures et professeurs et le personnel de soutien de certaines universités et de certains collèges préuniversitaires. Ses membres sont en grande partie des femmes.

[12] Comité conjoint UQAM-CSN-FTQ, 1977. Le protocole d'entente UQAM-CSN-FTQ : sur la formation syndicale. Services à la collectivité, Université du Québec à Montréal, CP 8888, Succ. A, Montréal (Québec) H3C 3P8.

Comité conjoint UQAM-CSN-FTQ, 1988. Le protocole UQAM-CSN-FTQ : 1976-1986. Bilan et perspectives. 36 pages. Services à la collectivité, Université du Québec à Montréal, CP 8888, Succ. A, Montréal (Québec) H3C 3P8.

Karen Messing «Putting our two heads together: A mainly women's research group looks at women's occupational health», dans Wine J. et Ristock J. Feminist Activism in Canada: Bridging Academe and the Community (Toronto: James Lorrimer Press, 1991). Réimprimé dans le National Women's Studies Association Journal, 3:355-67.

D'autres professeures ont rédigé des histoires de femmes, fourni de l'aide dans le cadre de programmes d'alphabétisation des femmes et fourni des renseignements sur les techniques de reproduction.

Ces protocoles d'entente fournissent des garanties tant aux groupes qu'au personnel enseignant. La chercheuse ou le chercheur conserve tous ses droits sur les résultats de l'étude, mais se doit de les partager avec le groupe. Les comités conjoints encadrent les projets, ce qui garanti le respect des objectifs initiaux. Plusieurs employées et employés à plein temps assument la responsabilité de coordonnatrices et coordonnateurs à plein temps des projets, avec pour tâche de mettre en corrélation les besoins de l'équipe de recherche et les besoins de la communauté. Notre travail se poursuit dans le contexte de notre convention collective. Cela signifie que les groupes ont accès à des professeures et professeurs réguliers plutôt qu'à des services spéciaux. Les groupes bénéficient des privilèges du statut de professeur universitaire, tels que l'accès aux services et aux subventions de l'université. L'activité de recherche initiée par la communauté, parfois perçue avec une certaine hostilité par la collectivité scientifique, doit être reconnue par notre employeur s'il ne veut pas courir le risque d'être confronté à des griefs dans le cadre de notre convention collective.

Le travail que nous avons accompli dans ce contexte a été passionnant et a, d'ailleurs, rapporté environ 500 000 $ par année à l'université sous forme de subventions extérieures. Avec les travailleuses, nous avons été en mesure de mieux comprendre leurs besoins et de leur fournir des renseignements utiles. Leur solidarité est une source de pouvoir pour nous toutes depuis bien des années, et leurs points de vue sont précieux. De la nettoyeuse qui nous explique pourquoi le «travail léger» est plus pénible que le «travail lourd» jusqu'aux techniciennes qui nous disent pourquoi les études du temps-et- mouvement ne constituent pas une façon adéquate d'organiser les traitements de radiothérapie, en passant par les travailleuses d'usine qui nous font comprendre combien il est important de pouvoir aller aux toilettes quand on en éprouve le besoin[13], les travailleuses nous ont constamment rappelé la réalité des problèmes de la santé au travail. Si nos collègues avaient des occasions et des renseignements similaires, peut-être contribueraient-ils à changer les règles de la recherche sur la santé au travail. En parlant aux travailleures et travailleurs, nous parviendrons peut-être à leur faire comprendre leur rôle dans les risques et les symptômes et à leur faire croire aussi combien il est important que leur santé soit protégée.

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[13] Les médecins affirment le contraire, mais les travailleuses ont eu gain de cause.

Organismes subventionnaires et participation communautaire

Nous avons obtenu le soutien de deux organismes subventionnaires québécois, qui incluent incluant des représentantes et représentants de groupes syndicaux et des groupes communautaires, dans nos efforts de levées de fonds. L'Institut de recherche pour la santé et la sécurité au travail du Québec compte des représentants des travailleurs et des patrons qui s'occupent explicitement de l'établissement des subventions; les deux parties négocient explicitement et ouvertement en vue de financer les travaux de recherche considérés importants. Fait paradoxal, cette méthode semble contribuer à réduire les partis pris en matière de financement étant donné que les conséquences pratiques des projets sont établies dès le début.

Les décisions du Conseil pour la recherche sociale du Québec sont prises en conjonction avec des représentants communautaires. Ils financent actuellement une de nos études sur les impacts et les conséquences des méthodes actuelles visant à harmoniser les responsabilités familières et professionnelles, une étude initiée par la FTQ.

Le gouvernement canadien offre également un programme de subventions en sciences sociales qui a impliqué des groupes de femmes. En tant que biologistes, nous n'aurions normalement pas droit à ces fonds. Toutefois, en raison de notre forte participation communautaire, nous (et les autres dans le domaine de la santé au travail) avons bénéficié d'un soutien précieux. En fait, une proportion beaucoup plus large de la recherche sur la santé des femmes au travail au Canada a été supportée par les organismes qui subventionnent les sciences sociales que par les organismes subventionnaires des sciences de la santé.

Bien entendu, notre modèle n'est pas unique. Les chercheures et chercheurs en éducation risquent de vouloir signer d'autres types d'ententes pour inclure le personnel enseignant et les élèves dans l'enseignement qui tiennent compte des genres.[14] Les peuples des Premières nations penseront à des façons d'établir la communication entre les praticiens de la santé traditionnels et ceux de l'extérieurs. Les personnes qui vivent en milieu rural développeront éventuellement d'autres méthodes pour communiquer avec les ingénieurs civils. Les organismes internationaux devront mettre sur pied leurs propres mécanismes visant à garantir la participation communautaire. Je tiens toutefois à mettre l'accent sur les caractéristiques cruciales de notre modèle :

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[14] Le collectif McClintock, à Melbourne, en Australie, est un modèle de recherche active en collaboration avec les étudiantes et étudiants et le personnel enseignant.

Reconnaissance explicite du déséquilibre de pouvoir entre les chercheuses professionnelles et les groupes communautaires, avec mise sur pied de structures visant à garantir que les besoins des deux parties soient reconnus tout au long du projet.
Garantie de la crédibilité scientifique, obtenue par le biais d'une certaine forme d'évaluation par les pairs. Bien que les comités d'évaluation par les pairs doivent se sensibiliser aux difficultés spécifiques de la recherche communautaire, ils fournissent une importante qualité aux groupes communautaires et aident à maintenir la crédibilité scientifique des chercheures.
Les droits de la recherche sont conservés par la chercheure. C'est un facteur d'encouragement essentiel pour les chercheures, qui accompagne fort bien leur responsabilité de fournir des résultats à leurs collaboratrices et collaborateurs.
Fonds disponibles à deux étapes : subventions de démarrage pour les études de faisabilité, souvent nécessaires avec les questions radicalement nouvelles que posent les groupes communautaires; des montants plus importants en provenance d'organismes qui incluent des membres de la communauté dans leur processus d'évaluation.

Nous semblons être assez loin des premières réunions de la GASAT. Pourquoi la recherche communautaire est-elle une question de genre dans les sciences et la technologie? Pour répondre à cette question, j'en reviens à mon discours d'ouverture, dans lequel j'ai essayé de démontrer que l'intégration des préoccupations des femmes dans les sciences et la technologie est une question de partage du pouvoir. Sans structures qui donnent aux femmes et autres groupes défavorisés le vrai pouvoir de déterminer le cours des sciences et de la technologie, nous ne parviendrons jamais à transformer ces institutions. D'autre part, comme nous avons pu le remarquer au cours des cinq derniers jours, le genre d'initiatives excitantes que les femmes ont développées constituent l'avenir des sciences et de la technologie.

ANNEXE
AUTRES QUESTIONS SOULEVÉES PAR LES PARTICIPANTES ET PARTICIPANTS

Stratégies en vue du changement

Collecte de données (responsables de la mise en oeuvre proposés : organismes gouvernementaux, chercheures et chercheurs)
Les données devraient être recueillies de façon telle qu'une analyse complète puisse être effectuée, combinant les données sur la classe, le sexe, l'ethnie et d'autres paramètres importants qui ont trait à l'équité.

Un exemple du contexte social de la technologie est le caractère inapproprié des collectes de données, même dans les pays qui jouissent d'une technologie d'avant-garde. Pour être en mesure d'agir, il est important d'obtenir des renseignements adéquats sur la participation des femmes dans les sciences et la technologie. Ces renseignements peuvent ensuite servir de base d'action.

Responsabilités familiales (responsables de la mise en oeuvre proposé : employeuses et employeurs)
Le fait que les écoles et autres milieux de travail aient été organisés en relation à un seul style de vie possible constitue un obstacle important à la pleine intégration des femmes.

Dans beaucoup de pays, des dispositions inadéquates pour les congés de maternité, la garde des enfants, les soins aux personnes âgées, les soins aux enfants malades, ainsi que pour de multiples autres tâches, empêchent les femmes de progresser, alors que des dispositions inadéquates en ce qui a trait au congé de paternité et au rapprochement des rôles nuisent à la contribution égale des femmes et des hommes au sein de l'unité familiale. Les étudiantes et étudiants et les travailleuses et travailleurs à temps partiel sont fréquemment parmi les plus défavorisés.

Structures de soutien (responsables de la mise en oeuvre proposés: employeuses et employeurs)
Étant donné que les préoccupations féministes peuvent nuire à la crédibilité des écoles et des milieux de travail, des structures de soutien devraient être créées et utilisées.

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On devrait prévoir des moments et des lieux où les femmes pourraient se réunir.

Technologie pensée en fonction des femmes (responsables de la mise en oeuvre proposés : systèomes des soins de la santé)
Il est important de penser au contexte social des technologies développées pour donner du pouvoir aux femmes, et plus particulièrement dans le domaine de la reproduction.

Dans l'exemple cité pendant la conférence, on a parlé des opérations que certains médecins pratiquaient pour redonner la virginité à une femme, accroissant la liberté d'action des femmes en tant qu'individu, sans pour autant remettre en question les prémises du système patriarcal. C'est une situation où des stratégies provisoires peuvent être utilisées par des individus pour se protéger, tout en s'engageant dans des actions politiques. Il faut tenir compte des besoins immédiats et à long terme des femmes.

Structures de collaoboration (responsables de la mise en oeuvre proposés : organisme de recherche, universités, systèmes scolaires, gouvernements, organismes de collaboration internationale, chercheures et chercheurs)
Des structures de collaboration devraient être mises sur pied pour que le personnel enseignant et les étudiantes et étudiants puissent s'impliquer dans les sciences et la technologie d'une façon responsable et avec le souci de l'égalité des sexes.

Comment faire pression pour favoriser l'équité des sexes dans les sciences et la technologie qui se développent dans une nouvelle région (responsables de la mise en oeuvre proposés : les femmes et les gouvernements des pays en voie de développement)
C'est un réseau de femmes avec des liens solides entre elles qui devraient exercer des pressions. La collaboration doit être établie avec les autorité politiques; si elles manquent de largeur d'esprit au départ, alors les tentatives échoueront. Dans nos efforts visant à intégrer les femmes et les jeunes filles, nous devons nous efforcer de redéfinir les institutions scientifiques et techniques. Des activités telles que des congrès de grande envergure constituent un bon point de départ.

Ces efforts peuvent être mis en oeuvre par un individu ou un organisme, mais devraient devenir un exercice communautaire. Les individus et groupes intéressés devraient se regrouper. Des activités visant les mères et leurs filles, les petites et grandes soeurs, devraient être envisagées.

Enseignement et formation

Connaissance scientifique (responsables de la mise en oeuvre proposés : toutes les personnes qui travaillent dans le domaine de l'éducation)
Tant dans les pays développés que dans les pays en voie de développement, la notion d'alphabétisation universelle devrait être élargie pour inclure la connaissance scientifique, l'acquisition d'un niveau minimal de compréhension des procédés scientifiques, des outils mathématiques et du monde physique.

Définition de la pédagogie féministe (responsables de la mise en oeuvre proposés : chercheures et chercheurs)
Plusieurs personnes refusent d'utiliser le terme «féministe» pour décrire leurs initiatives. La pédagogie féministe, telle qu'elle est habituellement définie, a deux composantes : les styles d'enseignement de collaboration et inclusifs et le contenu de l'enseignement, qui comprennent des questions concernant les genres et le pouvoir.

Nous n'avons pas encore établi si nous devrions ou non nous appeler des féministes; aucun consensus n'a été atteint parmi les membres de la GASAT.

Réduire l'écart entre l'expérience des femmes et les sciences et la technologie (responsables de la mise en oeuvre proposés : personnel enseignant et chercheures et chercheurs)
Il est essentiel de reconnaître et d'inclure dans l'enseignement des sciences et de la technologie les expériences quotidiennes des femmes, tout en mettant au défi les stéréotypes sexuels et la division sexuelle du travail. De tels obstacles peuvent menacer les rapports de classes sociales et hiérarchiques.

Il est important de mettre au point des techniques pouvant être utilisées dans les cours plus grands, étant donné que les budget sont faibles dans certains pays et en régression dans la plupart des autres.

Avoir recours à un personnel enseignant aussi proche que possible de la population estudiantine en termes d'antécédents et d'intérêts (responsables de la mise en oeuvre proposés : responsables des projets d'éducation)
Il est important que les professeures et professeurs comprennent lieu les orientations de leurs étudiantes et étudiants. Quand la clientèle est d'âge adulte ou une nouvelle population, la formation d'éducateurs choisis parmi les étudiantes et étudiants est avantageuse.

Par exemple, la formation de femmes provenant d'un milieu rural qui enseigneront à d'autres femmes de leur milieu. La sélection de ces éducatrices n'est pas facile.

Des cours pour femmes seulement: (responsables de la mise en oeuvre proposés: responsables des projets de recherche)
Dans certains cas, il est important pour les filles et pour les femmes d'apprendre séparément des hommes. De telles expériences sont souvent positives. Il est important que les raisons de la mise sur pied d'un tel apprentissage soient présentées aux étudiantes et étudiants.

Évaluation (responsables de la mise en oeuvre proposés : systèmes scolaires, universités, persgonnel enseignant et chercheures et chercheurs)
Les styles d'évaluation des étudiantes et étudiants devraient être équitables pour les deux genres. Les questions devraient être de diverse sortes et devraient être en rapport avec l'expérience humaine, dépeignant des hommes et des femmes dans leurs contextes social et environnemental.

Coopération et collaboration (responsables de la mise en oeuvre proposés : systèmes scolaires et universités)
Les techniques pédagogiques qui insistent sur une compétitivité extrême devraient être découragées.

Éthique (responsables de la mise en oeuvre proposés : écoles, universités, personnel enseignant et chercheures et chercheurs)
Des questions d'éthique devraient être intégrées au contexte de l'enseignement des sciences et être enseignées comme faisant partie du processus de prise de décisions.

On a encore affaire à des cas de cruauté inutile envers les animaux dans certains cours de biologie, phénomène qui contribue largement à l'aliénation des femmes de ce domaine. Dans certains cours de certains pays, des vidéos, des simulations sur ordinateur et des modèles remplacent les animaux vivants. Lorsque cela est impossible, l'enseignement devrait inclure le respect et les bons soins à l'égard des animaux.

Médias (responsables de la mise en oeuvre proposés : associations de communicateurs et communicatrices scientifiques, programmes de formation continue)
Des ateliers devraient être mis sur pied pour les communicatrices et communicateurs scientifiques, de façon à les encourager à rédiger des documents sur les femmes et les sciences.

PROPOSAL FOR GASAT 8

Jayshree Mehta

TOWARDS SUSTAINABLE DEVELOPMENT

ACHIEVING 4 Es - EDUCATION, EMPLOYMENT, EQUALITY AND EMPOWERMENT

Issues regarding Women, Development and Environment using Science and Technology have been a major concern to all of us. Science and Technology have not been used as a major tool for the development of women. This is because a large number of girls/women have no opportunity or access to learn science, understand the phenomena relating to changes in immediate environment or use simple technologies at any time in their lives. Science and Technology have developed without consideration of women as 'Users'. The link between environment, development and equality have to be meaningfully established keeping women in focus.

Women in developed as well as developing countries have experienced Science and Technology to be 'out of'their reach'. Several studies all over the world have shown that women are marginalised when new technologies are introduced. Agriculture, textiles, etc. are glaring examples of this. Similarly, basic health care is not available to large groups of women in the developing countries.

The complexity of factors influencing girls' involvement in Science and Technology and their discontinuing interests at adolescence have been apparent. The cultural stereotyping of males and females, the objective and organization of education systems and the images of Science and Technology and their presentation and practices are not encouraging to girls. Research on 'Gender issues in Science' reveals teachers' attitudes and text book presentation to be negative elements for girls participation in science.

The present mode of science education has not been able to create scientific literacy and scientific attitudes.

Looking into these problems, the Gender & Science & Technology group (GASAT) has organised seven GASAT Conferences so far. All of them were held in Developed countries.

A projection has been made by the group to organise the Eighth International Conference GASAT 8 in 1995 in one of the developing countries (in SOUTH) keeping in focus the following points/issues:

1) In most of the Developing countries, Science/Technology education courses are a bad copy or imitation from the west without taking into consideration the social, cultural and environmental fabric of the society. In common patriarchal societies, child rearing practices do not give importance to girls education. Science education courses in the schools are boring, passive and memory/information oriented. There is no relation of science in the school to science in their everyday life. Can we study what has emerged in different countries during the last decade? What are their impacts on Girls? Can we create new models?

2) Large numbers of girls (almost 50%) do not complete their primary schooling which results in massive illiteracy. The female literacy rate in India is only 40%. What type of non-formal Science and Technology education courses with various entry levels can be formed for such groups of young women? (15-35 years age group). What has been done in different developing countries in this context?

3) Women's participation in Science and Technology courses and their employment and careers are one of the major challenges in all parts of the world. With no facility for continuing education, women find it difficult to continue Science and Technology careers when they raise children. There are no adequate training courses or enrichment courses designed for women. Prejudice against women in employment in Science and Technology related areas is glaring. What can be done about it?

4) How can we take science ideas and simple technologies to women in rural areas? What are the forms and methods? Can we communicate science in a language that they understand using simple examples for their immediate environment?

5) 'Women friendly' and 'ECO friendly' Technologies have to be developed, identified and introduced into the science curriculums. Can we share our wealth of experiences and knowledge in this sphere?

6) How do we provide adult women with technology skills to generate income and to ease their work load? How can we make them participate in the questioning, decision making in society? How can we ensure that they become active members in the development process and not passive watchers?

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7) Many cultures have sound environmental practices which make development sustainable and viable. Can we make use of this knowledge for our future development? How can we preserve the knowledge possessed by indigenous people for future generations?

8) How do we inculcate values such as learning to use 'Science and Technology' for the development all, especially for women and other vulnerable groups in society rather than for the advantage of only the few who are most influential and powerful?

9) How can we demonstrate that a concern for the environment can be articulated through science and technology education which promotes sustainable development?

These are a few of the issues which need to be discussed and solutions sought for. It is important that women from many countries participate in this forum, share their experiences and look into gender related problems more seriously and search for remedies in their own countries. We believe that holding a Conference in India would give a valuable opportunity to women in all parts of the world.

We have the required human resources and infrastructure facilities for holding such a Conference in Ahmedabad, Gujarat. Some of the reputed organisations working for women's development such as Self Employed Women's Association (SEWA), Ahmedabad Women Action Group (AWAG), etc. are in Ahmedabad. There will be an opportunity for the participants to observe the work being carried out by them.

We have conviction, courage and confidence for taking up this responsibility but we need financial support. With the generous support, help and guidance from many GASAT 8 can be successfully held in India in 1995.

APPENDIX A: ADDRESS LIST OF PARTICIPANTS

Anne Abbott
CRCC Consumer Researcher
Collaboration Committee
49 Green Lane, # 201
Thornhill, Ontario
Canada
L3T 7M9
Telephone 1-416-764-3391
RTRDCAA@UTOROISE.BITNET

Fran Abramowitz
Canadian National
935 de la Gauchetiere West
Montreal, Quebec
Canada
H3B 2M9
Telephone 1-514-399-7675
Fax 1-514-399-7721

Sandra Acker
Ontario Institute for Studies
in Education
Dept. of Sociology in Education
252 Bloor Street West
Toronto, Ontario
Canada
M5S IV6
Telephone 1-416-923-6641
Fax 1-416-926-4725
SACKER@OISE.UTORONTO.CA

Eiwor Acosta
University of Lund
Box 117
Lund
Sweden
5-221 00
Telephone 46-46-107010
Fax 46-46-104711

Alain Aeschelmann
Ministry of Education and
Training
Curriculum Policy Development
16th Floor, Mowat Block
900 Bay Street
Toronto, Ontario
Canada M7A IL2
Telephone 1-416-325-2572
Fax 1-416-325-2575

Rosy Agholor
Curtin University of Technology
SMEC GPO Box U 1987
Perth 6001
Australia
Telephone 61-9-351-7896
Fax 61-9-351-2503

Andrea Allard
University of Melbourne
Parkville, Victoria 3052
Australia
Telephone 61-3-344-8205
Fax 61-3-347-2468

Nessy Allen
University of New South Wales
Schl of Science & Tech. Studies
P.O. Box 1
Kensington, New South Wales,
Australia 2033
Telephone 61-2-679-2362
Fax 61-2-313-7984
N.ALLEN@UNSW.EDU.AU

Joan Amarteifio
Botswana College of Agriculture
PTE Bag 0027
Gaborone
Botswana
Telephone 352381
Fax 314253

Inger Anderson
2429 Clarence Avenue South
Saskatoon, Saskatchewan
Canada
57J IMI
Telephone 1-306-343-5844

Mary Anderson
Arizona State University
Dept. of Ind. and Mgt. System
Engineering
Arizona State University
Tempe, Arizona
U.S.A.
85287-5906
Telephone 1-602-965-3815
Fax 1-602-965-8692

Nan Armour
Armour and Associates
1331 Brenton Street
Halifax, Nova Scotia
Canada
B3J 2K5
Telephone 1-902-422-5953
Fax 1-902-422-1415

Dr Tortiv Ato
Suleja Academy
P.M.B. 20
Suleja
Nigeria, Niger State
Telephone 044-31231

Lisa Avedon
Ontario Ministry of Labour
Office of Labour Adjustment
400 University Ave., 9th Fl
Toronto, Ontario
Canada M7A IT7
Telephone 1-416-326-7375
Fax 1-416-326-7383

Shirley Avril
Ministry of Education
Gender Equity Programs
525 - 620 Superior Street
Victoria, B.C.
Canada
V8V 2M4
Telephone 1-604-356-8368
Fax 1-604-387-1418

Harriet Axelsson
University of Halmsad
Box 823
30118 Halmstad
Sweden
Telephone 46-35-153100
Fax 46-35-740363
E-MAIL:
HARRIET.AXELSSON@LPP.HH.SE

Alison Baignée
Canadian Council of
Professional Engineers
401-116 Albert Street
Ottawa, Ontario
Canada
KIP SG3
Telephone 1-613-232-2474
Fax 1-613-230-5759

Kathy Banks
Queensland University of
Technology
c/o 19 Barramundi Avenue
North Nowra, NSW 2541
Australia
Telephone 61-4-421-0356

Dr Judith Bazler
Lehigh University
SMART Center
309 Coppee Hall
Bethlehem, PA
U.S.A.
18015-3165
Telephone 1-215-758-3238
Fax 1-215-758-6208
JABI@LEHIGH.EDU

Mary Beam
Ontario Teachers' Federation
1260 Bay Street
5th Floor
Toronto, Ontario
Canada
M5R 2B5
Telephone 1-416-966-3424
Fax 1-416-966-5450
MBEAM@UTOROISE.BITNET

Margaret Bearlin
Faculty of Education
University of Canberra
P.O. Box 1
Belconnen, A.C.T., 2616
Australia
Telephone 61-6-252-2111
Fax 61-6-201-5999

Karin Beyer
IMFUFA, Roskilde University
P.O. Box 260
Roskilde
Denmark
DK-4000
Telephone 45-46-757711
Fax 45-46-755065
KARIN@MMF.RUC.DK

Kamalini Bhansali
92-B, Maker Towers
Cuffe Parade
Bombay
India
400005
Telephone 91-2221-87204
Fax 91-2221-86885

Dr. Kamlesh Bhatia
Bombay Teachers' Training
College, University of Bombay
Mahakavi Bhushan Rd
Colaba, Bombay
India
400-039
Telephone 91-0222-047160
Fax 91-0222-876010

Lesley Biggs
University of Saskatchewan
Saskatoon, Saskatchewan
Canada S4N OWO
Telephone 1-306-343-6717
Fax 1-306-966-6950

Norma Blazquez Graf
Programa Universitario de
Estudios de Genero
Circuito Mtre. Mario de la Cueva
Cd. de la Investigacion en
Humanidades, Zona Cultural
Cd. Universitaria
Mexico 04510
Telephone 550-78-89
Fax 606-97-79

Thora Margaret Blithe
Victoria University of
Wellington
P.O. Box 600
Wellington
New Zealand 6005
Telephone 04-495-5115
Fax 04-495-5118
THORA.BLITHE@UUW.AC.NZ

Kis Bonde
Baunebjerg School
Postbox 100
3050 Humlebaek
Denmark
Telephone 45-42190322

Suzanne Brainard
University of Washington
101 Wilson Annex, FC-08
Seattle, Washington
U.S.A. 98195
Telephone 1-206-543-4810
Fax 1-206-685-4860
BRAINARD@ENGR.WASHINGTON.EDU

Marcia Braundy
WITT National Network
R.R. 1
Winlaw, B.C.
Canada VOG 2JO
Telephone 1-604-226-7624
Fax 1-604-226-7954
SOLIVET-BRAUNDYM

Anne Bridges
General Mills, Inc
9000 Plymouth Ave.
Minneapolis, Minnesota
U.S.A.
55427
Telephone 1-612-540-3712
Fax 1-612-540-7487

Susan Brown
University of Melbourne
Faculty of Science
Parkville, Victoria, 3052
Australia
Telephone 61-3-344-4000
Fax 61-3-344-5803
SUSAN BROWN@MUWAYF.UNIBELB.EDU.AU

Kathy Browning
1791 Walnut Lane
Pickering, Ontario
Canada
LIV 2X5
Telephone 1-416-839-3063

Sandra Bruzga
Giralang Primary School
12 Cowan Street
Downer, A.C.T.
Australia
2602
Telephone 61-6-205-5866
Fax 61—6—241—1912

Hansity Bundi
Kiambu Institute of Science and
Technology
P.O. Box 414
Kiambu
Kenya
Telephone 254-154-22894

Marilyn Carr
United Nations Development Fund
for Women
304 East 45th Street
New York, NY
U.S.A.
10017
Telephone 1-212-906-6400
Fax 1-212-906-6705

Ruth Carter
Open University
Fairfax House
Merrion Street
Leeds
United Kingdom LS2 8JU
Telephone 44-532-444431
Fax 44-532-341862
R.B.CARTER@UK.AC.OPEN

Dr Indira Chacko
ICEE, University of Ibadan
Institute of Education
Ibadan
Nigeria
Telephone 234-022-315078
Fax 234-022-317978

Dr. Dinesh Chandra
RBS College of Education
Agraz
India
282002
Telephone 73924

Dr. Kamala Chandrasekhar
Family Planning Association of
India
24A, II Main Road
Raja Annamalai Puram,
Madras-600028
India
Telephone 457047

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Ms Olive Chapman
The University of Calgary
2500 University Drive N.W.
Calgary, Alberta
Canada
T2N IN4
Telephone 1-403-220-5640

Silvia Chavarria
Universidad de Costa Rica
Escuela de Computacion
San Jose
Costa Rica
Telephone 53-53-23 *4020
Fax 53-60-75
SILVIACH@UCRVMZ.Bitnet

Ms Christie Chawanje
University of Malawi
The Polytechnic
Private Bag 303
Chichiri
Blantyre 3
Malawi
Telephone 265-670411
Fax 265-670578

Deborah Chetcuti
4 Palm Court
Robert Mifsud Bonnici Street
Lija
Malta
Telephone 356-430-146

Dr. Hilda Ching
P.O. Box 2184
Vancouver, B.C.
Canada
V6B 3V7
Telephone 1-604-736-0757
Fax 1-604-291-4967

Stobias Mwape Chubili
Ministry of Higher Education
Private Bag RW 16
Lusaka
Zambia
Telephone 260-1-25160
Fax 260-1-252382

Dr. Dilek Cindoglu
Bilkent University
Department of Political
Sciences and Public
Administration
Ankara
Turkey
06533
Telephone 266-41-37
Fax 904-266-41-27
CINDOGLU@TRBILUN

Dr. Maria Cirino
Dept. of Pharmacology
Merck Frosst Center Therapeutic
Research
16711 Trans Canada Highway
Kirkland, Quebec
Canada
H9H 3LI
Telephone 1-514-428-3917
Fax 1-514-695-0693

Dr. Val Clarke
Deakin University
Faculty of Health & Behavioural Sciences
Geelong Campus
Victoria
Australia 3217
Telephone 61-5-227-1413
Fax 61-5-227-2021
VAC@DEAKIN.EDU.AU

Madeleine Comeau
YW-NOW
1217 Barrington Street
Halifax, Nova Scotia
Canada
B3J IY2

Gerry Connelly
Toronto Board Of Education
155 College Street
Toronto, Ontario
Canada
M5T IP6
Telephone 1-416-397-3804
Fax 1-416-397-3813

Esther Conwell
National Research Council
2101 Constitution Avenue
N-W 2133-212
Washington, D.C.
U.S.A.
20418
Telephone 1-202-334-1372
Fax 1-202-334-2753
GDAVIDSO@NAS.EDU

Cecile Crutzen
Open University, Department
Tech. Science
P.O. Box 2960
Heerlen
The Netherlands
6401 DL
Telephone 0131-45-762573
Fax 0131-45-711486
CCR@OUH.N4

Wendy Cukier
Ryerson Polytechnical Institue
350 Victoria Street
Toronto, Ontario
Canada
M5B 2K3
Telephone 1-416-979-5000
Fax 1-416-979-5249

Joseph Cumo
Ashtabula County Schools
P.O. Box 186
Jefferson, Ohio
U.S.A.
44047

Dr. Anne Innis Dagg
University of Waterloo
Independent Studies
Waterloo, Ontario
Canada
N2L 3GI
Telephone 1-519-885-1211
Fax 1-519-746-7326

Ms. Mona Dahms
Institute of Electronic,
Aalborg University
Frederik Bajers Vej 7
Aalborg
Denmark DK-9220
Telephone 4598158522
Fax 4598156740
MDAKOM.AUC.DK

Jane Dalton
Here Today...Where Tomorrow?
R.R.# 3
Caledon East, Ontario
Canada LON 1EO
Telephone 1-416-880-1959
Fax 1-416-880-0880

Jane Daniels
c/o National Science Foundation
Divison Human Resouces
Development
1800 G Street NW
Washington, D.C.
U.S.A.
20550
Telephone 1-202-357-7552
JDANIELS@NSF.GOV

Cinda-Sue Davis
University of Michigan
330 E. Liberty
Ann Arbor, Michigan
U.S.A.
48104-2289
Telephone 1-313-998-7225
Fax 1-313-998-6203

Fran Davis
Vanier College
821 boul. Ste-Croix
Saint-Laurent, Quebec
Canada H4L 3X9
Telephone 1-514-744-7120
Fax 1-514-744-7952

Luigia De Divitiis
Ontario Science Centre
770 Don Mills Road
Don Mills, Ontario
Canada M3C IT3
Telephone 1-416-696-3104
Fax 1-416-696-3197

Isabelle Deschamps
Ecole des H.E.C.
5255 Avenue Decelles
Montreal, Quebec
Canada
H3T IV6
Telephone 1-514-340-6282
Fax 1-514-340-5632

Bev Dick
McClintock Collective
25 Ormond Street
Kensington
Australia
3031
Telephone 61-3-428-8221
Fax 61-3-429-1927

Marilyn Dickson
F.W.T.A.O.
1260 Bay Street
Toronto, Ontario
Canada
M5R 2B8
Telephone 1-416-964-1232
Fax 1-416-964-0512
MDICKSON@UTOROISE.BITNET

Juliana Dogbe
Accra Polytechnic
P.O. Box 561
Accra
Ghana
Telephone 233-21-662263

Norma Dogger
Simcoe County Board of
Education
Box 72
Lisle, Ontario
Canada
LOM IM0
Telephone 1-705-424-6767
Fax 1-705-728-2265

Kat Downey
George Brown College
10 Conway Ave
Toronto, Ontario
Canada
M6E IH2
Telephone 1-416-656-8352

Mildred Dresselhaus
National Research Council
2101 Constitution Avenue
N-W 2133/212
Washington, DC
U.S.A.
20418
Telephone 1-202-334-1372
Fax 1-202-334-2753
GDAVIDSO@NAS.EDU

Marielle Dufresne
Ordre des ingenieurs du Québec
2020 rue University
18e étage
Montréal, Québec
Canada
H3A 2A5
Telephone 1-514-845-6141
Fax 1-514-845-1833

Alan Durndell
Glasgow Polytechnic
Dept. Psychology
Cowcaddens Road
Glasgow, Scotland
United Kingdom
G4 OBA
Telephone 041-331-3000

Lillian Dyck
Women Studies Research Unit
c/o Neuropsychiatric Research
A136MRB, University of
Saskatchewan
Saskatoon, Saskatchewan
Canada
Telephone 1-306-966-8823
Fax 1-303-966-8830

Dr. Dormer Ellis
University of Toronto
47 Yorkview Dr.
Willowdale, Ontario
Canada
M2N 2R9
Telephone 1-416-221-5302
Fax 1-416-926-4725

Judy Emms
Open University in Wales
24 Cathedral Road
Carciff
United Kingdom
CFI 95A
Telephone 44222397911
Fax 44222227930
J.M.EMMS@UK.AC.OPEN

Mary Ann Evans
Iowa State University
209 Lab of Mechanics
Ames, Iowa
U.S.A.
50011
Telephone 1-515-294-5883
Fax 1-515-294-8844
S2.MAE@ISUMVS

Linda Eyre
Faculty of Education
University of New Brunswick
Fredericton, New Brunswick
Canada
E3B 5A3
Telephone 1-506-453-3500
Fax 1-506-453-3569

Javier Flores Lopez
National University of Mexico
Cerro De Chapultepec
82 Romero de Terreros
Coyoacan
Mexico 04360
Telephone 554-32-23
Fax 9011525508859

Bruce Fowler
National Research Council
2101 Constitution Avenue
N-W 2133-212
Washington, D.C.
U.S.A. 20418
Telephone 1-202-334-1372
Fax 1-202-334-2753
GDAVIDSO@NAS.EDU

Sharon Frantz
Discovery Consortium Inc.
#11, 10160 - 119 Street
Edmonton, Alberta
Canada
T5K IY9
Telephone 1-403-428-8891
Fax 1-403-428-1729

Monique Frize
Northern Telecom / NSERC Women
in Engineering Chair
University of New Brunswick
Department of Electrical
Engineering P.O. Box 4400
Fredericton, N.B.
Canada E3B 5A3
Telephone 1-506-453-4561
Fax 1-506-453-3568

Marlene Gallant
Bell Canada
1050 Beaver Hall Hill, Rm 305
Montreal, Quebec
Canada
H2Z IS4
Telephone 1-514-391-9102
Fax 1-514-870-5751
MGALLANT

Dr. Sudha Gangal
Indian Women Scientists' Ass'n
c/o Head, Immunology Division,
Cancer Research Institute
Tata Memorial Centre
Parel, Bombay
India 400 012
Telephone 91-2241-23803
Fax 91-2241-46089

Jim Gaskell
Faculty of Education, U.B.C.
2125 Main Mall
Vancouver, B.C.
Canada V6T IZ4
Telephone 1-604-822-5826
Fax 1-604-822-4714
JIMGASK@UNIXG.UBC.CA

Art Geddis
University of Western Ontario
1137 Western Rd.
London, Ontario
Canada N6G IG7
Telephone 1-519-661-2083
Fax 1-519-661-3833
GEDDIS@EDU.UWO.CA

Patsy Ann Giese
Slippery Rock
Pennsylvania
Department of Secondary Education
Foundations of Education
Slippery Rock, Pennsylvania
U.S.A. 16057-1326
Telephone 1-412-738-2317
Fax 1-412-738-2880
PAG@SRUVM.SRU.EDU

Jane Gilbert
University of Waikato University
Centre for Science &
Mathematics Education Research
Private Bag 3105
Hamilton, New Zealand
Telephone 64-07-856-2889

Caroline E. Polak Scowcroft (Gill)
c/o Centro Internacional de Agricultura
Tropical
Dirección postal: AA6713
Cali, Colombia
Telex: 05769 CIATCO
Telephone 57-23-675050
Fax 57 23 647243

Jacqueline Gill
Society for Canadian Women in
Science and Technology
2423-515 West Hastings
Vancouver, B.C.
Canada
V6B 5K3
Telephone 1-604-291-5163
Fax 1-604-291-5112
SCWIST@SFU.CA

BEST COPY AVAILABLE

Catherine Gillbert
Champlain College
900 Riverside Drive
St. Lambert, Quebec
Canada
J4P 2P2
Telephone 1-514-672-1519
Fax 1-514-672-9299

Caroline Godin
780 de Belmont
Apt. #307
Ste-Foy, Quebec
Canada
GIV 2W9
Telephone 1-418-659-3325

Gayle Goodfellow
University of Waterloo
200 University Ave West
Waterloo, Ontario
Canada
N2L 3GI

Clara Greed
92 Hillside Road
Redcliffe Bay
Portishead, Bristol
England
BS20 8LJ
Telephone 0272656261
Fax 0272763895

Paula Greenberg
Sir Wilfred Laurier Secondary
School
450 Millbank Drive
London, Ontario
Canada
N6C 4W7
Telephone 1-519-681-2080
Fax 1-519-681-5572

Brenda Grzetic
Women in Trades in Technology
Box 42, RR#I
Torbay, Newfoundland
Canada
AOA 3Z0
Telephone 1-709-754-3670

Sharon Haggerty
University of Western Ontario
Faculty of Education
1137 Western Road
London, Ontario
Canada
N6G IG7
Telephone 1-519-661-2084
Fax 1-519-661-3833
HAGGERTY@EDU.UWO.CA

Karen Hansen
University of Western Ontario
Faculty of Engineering Science
Room 40, Engineering building
London, Ontario
Canada
N6A 5B9
Telephone 1-519-661-2111
Fax 1-519-661-3502
DISCOVER@CHARON.ENGGA.UWO.CA

Kirsten Gonbaeu Hansen
University of Copenhagen
Center for Feminist Studies
Njalsgade 106
Copenhagen 5
Denmark
DK-2300
Telephone 45-31-542211
Fax 45-32-961518

Agneta Hansson
Halmstad University
Centre for Worklife Development
Box 823
30118 Halmstad
Sweden
Telephone 46-35-153100
Fax 46-35-157387

Jan Harding
6 Ullswater Grove
Alresford
Hampshire
England
S024 9NP
Telephone 0962-733327
Fax 0962-733327

Elaine Harvey
137 Inverness Crescent
Kingston, Ontario
Canada
K7M 6G9
Telephone 1-613-544-1392
Fax 1-613-544-1392

Debra Hayes
ACU Castle Hill Campus
521 Old Northern Road
Castle Hill, NSW 2124
Australia
Telephone 61-2-739-2875
Fax 61-2-739-2805

Elizabeth Hazel
Centre for Learning and
Teaching
University of Technology
P.O. Box 123
Broadway NSW 2007
Australia
Telephone 61-2-330-2200
Fax 61-2-330-2217

Ena Healy
Glasgow Caledonian University
Dept. of Engineering
Cowcaddens Rd, Glasgow
United Kingdom
G4 OBA
Telephone 041-331-3572
Fax 041-331-3005

Tina Herrera
University of California
MAME Dept
Davis, California
U.S.A.
95616
Telephone 1-916-753-8558
Fax 1-916-752-4158

Gaell Hildebrand
Institute of Education
University of Melbourne
CTAL Department
Parkville, Victoria, 3052
Australia
Telephone 61-3-344-8442
Fax 61-3-347-2468
GAELL_HILDEBRAND@MAC.UNIMELBEDUE-MAIN.AU

Christine Hill
Prescott-Russell County Board
of Education
675 Hamilton Road
Russell, Ontario
Canada, K4R 1E5
Telephone 1-613-445-3435

Penny Hillier
University of Waterloo
200 University Ave West
Waterloo, Ontario
Canada
N2L 3GI

Peter Hiscocks
Ryerson Polytechnical Institute
55 Grandview Avenue
Toronto, Ontario
Canada
M4K IJI
Telephone 1-416-465-3007
Fax 1-416-979-5280

Colin Hocking
9 Abbot Grove
Clifton Hill 3068, Victoria
Australia
Telephone 61-3-365-2322
Fax 61-3-365-2465

Barbara Hodgson
The Open University
Institute of Educational
Technology
Walton Hall
Milton Keynes
England
MK7 6AA
Telephone 0908-652620
Fax 0908-653744
B.K.HODGSON@OPEN.AC.UK

Carol Hollenshead
University of Michigan
330 E. Liberty
Ann Arbor, Michigan
U.S.A.
48104-2289
Telephone 1-313-998-7240
Fax 1-313-998-6203

Ann Holmes
Ontario Women's Directorate
2 Carlton Street
12th Floor
Toronto, Ontario
Canada
M5B 2M9
Telephone 1-416-314-0351
Fax 1-416-314-0256

BEST COPY AVAILABLE

Sophia Huyer
IFIAS
39 Spadina Road
Toronto, Ontario
Canada
MSR 2S9
Telephone 1-416-926-7570
Fax 1-416-926-9481

AnnMarie Israelsson
Teknikens Hus
S-971 87
Lulea
Sweden
Telephone 46-92-072208
Fax 46-92-072202

Val Johnston
R.R. 1
Drumbo, Ontario
Canada
NOJ IGO
Telephone 1-519-463-5646

Lynne Joslyn
8 Gipps Street
Bronte, New South Wales, 2024
Australia
Telephone 61-2-389-4986

Dr. Ahbor Dolly Ighoroje
University of Benin
Physiology Dept.
Postal Box 10616
Benin City
Nigeria
Telephone 052-200250

Sangster Muleya Jere
Technical and Vocational
Teachers College
P.O. Box 90199
Luanshya
Zambia
Telephone 02-512-662/244
Fax 02-512-408

Karen Joseph
American Indian Science and
Engineering Society - UBC
1710 East Pender Street
# 406
Vancouver, British Columbia
Canada V5L IW4
Telephone 1-604-255-9147
Fax 1-604-822-8944
KJOSEPH@UNIXG.UBC.CA

Felicitas Katepa-Mupondwa
University of Manitoba
Plant Science Department
Winnipeg, Manitoba
CanadaR3T 2N2
Telephone 1-204-474-6674
Fax 1-204-261-5732

Trish Koontz
Kent State University
404 White Hall
Kent, Ohio
U.S.A.
44242
Telephone 1-216-672-2580
Fax 1-216-672-3407

Kari Krogh
OISE, Dept. of Instruction and
Special Education
252 Bloor Street West
Toronto, Ontario
Canada
M5S IV6
Telephone 1-416-923-6641
Fax 1-416-926-4725
KKROGH@UTOROISE.BITNET

Yvonne Leaf
R.R. #3 East
Cornwall Island
Ontario
Canada
K6H 5R7
Telephone 1-613-932-1387

Lyne Leclerc
Industry and Science Canada
235 Queen Street
8th Floor West Tower
Ottawa, Ontario
Canada
KIA OH5
Telephone 1-613-990-3993
Fax 1-613-991-0363
LECLERC.LYNE@ISTC.CA

Cheryl Kristjanson
Daniel McIntyre High School
720 Alverstone St.
Winnipeg, Manitoba
Canada
R3E 2HI
Telephone 1-204-783-7131
Fax 1-204-783-9286

Anne-Marie Kubanek
John Abbott College
P.O. Box 2000
Ste-Anne-de-Bellevue, Quebec
Canada
H9X 3L9
Telephone 1-514-457-6610
Fax 1-514-457-4730

Jeanette Learmont
Swinburne University of
Technology
P.O. Box 218
Hawthorn, Victoria, 3122
Australia
Telephone 61-3-819-8633
Fax 61-3-819-8643

Barb Leek
Here todayWhere tomorrow
P.O. Box 1206
213 James Street
Bracebridge, Ontario
Canada
PIL IR8
Telephone 1-416-880-1959
Fax 1-416-880-0880

Karen Levine
British Columbia Hydro
6911 Southpoint Drive (E13)
Burnaby, British Columbia
Canada
V3N 4X8
Telephone 1-604-528-7762
Fax 1-604-528-7781

Sue Lewis
Swinburne University of
Technology
P.O. Box 218
Hawthorn
Australia
3122
Telephone 61-3-819-8633
Fax 61-3-819-8643

Jennifer Lindley
Swinburne University of
Technology
P.O. Box 218
Hawthorn, Victoria, 3122
Australia
Telephone 61-3-819-8633
Fax 61-3-819-8643

Hilary Lips
Centre for Gender Studies
University of Radford
Dept. of Psychology
Radford, VA
U.S.A.
24142
Telephone 1-703-831-5792
Fax 1-703-831-6113
HLIPSAJAMES.PSYCH.RUNET.EDU

Dr Gillian Lovegrove
Staffordshire University
School of Computing
Beaconside, Stafford
United Kingdom
ST18 OAD
Telephone 44-785-275425
Fax 44-785-55334
G.L.LOVEGROVE@STAFFS.AC.UK

Rebecca Lubetkin
Consortium for Educational
Equity
Rugters, The State University
4090 Livingston Campus
New Brunswick, NJ
U.S.A. 08903
Telephone 1-908-932-2071
Fax 1-908-932-0027

Denyse Lukowiecki
Scottish Consultative Council
on the Curriculum
Gardyne Road Broughty Ferry
Dundee, Scotland
United Kingdom
DD5 INY
Telephone 382-455053
Fax 382-455046

Sherri Lyle
OISE, Dept. of Instruction and
Special Education
252 Bloor Street West
Toronto, Ontario
Canada
M5S IV6
Telephone 1-416-923-6641
Fax 1-416-926-4725

Madeleine MacIvor
First Nations House of Learning
1985 West Mall
Vancouver, B.C.
Canada
V6T IK8
Telephone 1-604-822-8941
Fax 1-604-822-8944

Toni MacNeil
Gabriel Dumont Institute
505 23rd Street East
2nd Floor
Saskatoon, Saskatchewan
Canada
57K 4K7
Telephone 1-306-934-4941
Fax 1-306-244-0252

Shirley Malcom
American Association for the
Advancement of Science
Education and Human Resources
Program
1333 H Street NW, 11th Floor
Washington D.C.
U.S.A.
20005

Jeffry Mallow
Dept. of Physics
Loyola University
6525 N. Sheridan Road
Chicago, IL
U.S.A.
60626
Telephone 1-312-508-3546
Fax 1-312-508-3534

Dr. Sientje Mandang
Women in Science and Technology
EIUDP, DIT-JEN Pendidikan
Tinggi, Dept. Pendidikan Dan
Kebudayaan
JLN. Pintu I, Senayan,
P.O. Box 25
Jakarta, Indonesia
Telephone 62-21-5706061
Fax 62-21-5706060

Jean Denby Manis
University of Michigan
330 E. Liberty
Ann Arbor, Michigan
U.S.A.
48104-2289
Telephone 1-313-998-7225
Fax 1-313-998-6203

Francoise Marchand
Ecole de Technologie Superieure
4750, Rue Henri-Julien
Montreal, Quebec
Canada
H2T 2C8
Telephone 1-514-298-8965
Fax 1-514-298-8755

Zephania Matanga
OISE, Dept. of Instruction and
Special Education
252 Bloor Street West
Toronto, Ontario
Canada
M5S IV6
Telephone 1-416-923-6641
Fax 1-416-926-4725

BEST COPY AVAILABLE

Barbara McCann
CIDA
197 James Street
Ottawa, Ontario
Canada
KIR 5M6
Telephone 1-613-231-2655
Fax 1-613-231-2829

Elizabeth McKinley
University of Waikato
Centre for Science &
Mathematics Education Research
Private Bag 3042
Hamilton
New Zealand
Telephone 64-07-856-2859
Fax 64-07-856-7665
MCKINLEY@WAIKATO.AC.NZ

Lois McLean
McLean Media
19 Locke Lane
Mill Valley, California
U.S.A.
94941-2112
Telephone 1-415-332-6385
Fax 1-415-332-6388

Jayshree A. Mehta
Scientist, SATWAC
Vikram Sarabhai Community
Science Centre
'Ami-Jyot', Parimal Society
Ellisbridge, Ahmedabad
Gujarat India 380006
Telephone 91-272-428991
Fax 91-272-416941

Dr. Betsy McGregor
International Development
Research Council
250 Albert Street
Ottawa, Ontario
Canada
KIG 3H9
Telephone 1-613-236-6163
Fax 1-613-594-5946

Margaret McKinnon
University of Ottawa
Faculty of Education
145 Jean Jacques Lussier
Ottawa, Ontario
Canada
KIN 6N5
Telephone 1-613-564-7766
Fax 1-613-564-9098

Shawna Meade
Ministry of Advanced Education,
Training and Technology
Science and Technology Division
2nd Floor, 1022 Government
Victoria, British Columbia
Canada
V8V IX4
Telephone 1-604-387-2033
Fax 1-604-356-0021
SMEADE@GALAXY.GOV.BC.CA

Karen Messing
Universite du Quebec a Montreal
CINBIOSE
C.P. 8888, Succursale A
Montreal, Quebec
Canada H3C 3P8
Telephone 1-514-987-3334
Fax 1-514-987-6183
R30630@ER.UQAM.CA

Irene Mikawoz
University of Manitoba, Faculty
of Engineering
Room 350, Engineering Building
Winnipeg, Manitoba
Canada
R3T 5V6
Telephone 1-204-474-8497
Fax 1-204-275-3773
MIKAWOZ@CCU.UMANITOBA.CA

Georgette Mitchell
Sudbury Board of Education
59 Radcliff Park
Sudbury, Ontario
Canada
P3E 5Y5
Telephone 1-705-523-2380

Ken Moffatt
129 Brunswick Avenue
Toronto, Ontario
Canada
M5S 2M3
Telephone 1-416-962-0916

Nancy Moore
Moore Learning
240 Roselawn Ave
Toronto, Ontario
Canada
M4R IE9
Telephone 1-416-487-1077
Fax 1-416-487-1077

Ilya Mottier
Ministry of Education
Nieuwe Rijn 77
2312 JK Leiden
The Netherlands
Telephone 31-79-532620
Fax 31-79-531953

Dr. Jane Mulemwa
Makerere University
Department of Science and
Technical Education, DOSATE
P.O. Box 7062
Kampala
Uganda
Telephone 25-641-542471
Fax 25-641-245580

Kerrie Mullins-Gunst
K*M*G Consulting
14 Sutton Street
North Balwyn, Victoria, 3104
Australia
Telephone 61-3-859-3924
Fax 61-3-859-3924

Patricia Murphy
School of Education
The Open University
Milton Keynes
Buckinghamshire
England
MK7 6AA
Telephone 0908-652763
Fax 0908-653744

Dr. Faye Murrin
Department of Biology
Memorial University of
Newfoundland
St. John's, Newfoundland
Canada
AIB 3X9
Telephone 1-709-737-8018
Fax 1-709-737-4000
FMURRIN@KEAN.UCS.MUN.CA

Rose Mutalya
Uganda Polytechnic Kyambogo
P.O. Box 7181
Kampala
Uganda
Telephone 256-41-285211

Dr. Esther Mwangi
The International Centre of
Insect Physiology and Ecology
P.O. Box 30772
Nairobi
Kenya
Telephone 252-2-802501
Fax 254-2-803360

Dr. Ratna Naik
Tata Institute of Social
Sciences
P.B. 8313, Sion-Trombay Road
Deonar, Bombay
India
400088
Telephone 91-5563-28990
Fax 91-2255-25657

Mala Naraine
Consumer Researcher
Collaboration Committee
806 Kennedy Road
Apt. 505
Scarborough, Ontario
Canada
MIK 2EI
Telephone 1-416-759-2733

Jennifer Nathan
Association of Professional
Engineers
Box 3954
Whitehorse, Yukon
Canada
YIA 5M6
Telephone 1-403-633-5522
Fax 1-403-667-6727

Mrs. Jayantee Naugah
Mauritius Institute of
Education
Department of Science Education
Reduit
Mauritius
Telephone 454-1032-6
Fax 230-454-1037

Elinor Nicoll
Halifax District School Board
1649 Brunswick Street
Box 370
Halifax, Nova Scotia
Canada B3J 2RI
Telephone 1-902-421-6474
Fax 1-902-423-1618

Jean Nielsen
Syncrude Canada Ltd.
P.O. Box 4023, MD 7080
Fort McMurray, Alberta
Canada
T9H 3H5
Telephone 1-403-790-6509
Fax 1-403-790-6519

Dr. Ola Nnadi
McMaster University
Department of Civil Engineering
1280 Main Street West
Hamilton, Ontario
Canada
L85 4L7

Lillebit Nordhus
The Directorate of Labour
Bakkevn,. 14
3121 Tønsberg
Norway
Telephone 47-33-22584
Fax 47-33-18685

Valerie Norlen
Carleton University
Dept. of Sociology
Colonel By Drive
Ottawa, Ontario
Canada
KIS 5B6
Telephone 1-613-788-2600

Paul Nyambala
Commonwealth Association of
Polytechnics in Africa
Kenya Polytechic
P.O. Box 52428
Nairobi
Kenya
Telephone 254-2-338156
Fax 254-2-338156

Sue O'Brien
Myrtle Park Primary School
Tanga, Tasmania
Australia
7259
Telephone 61-3-993-354
Fax 61-3-993-487

Joyce Nyhof-Young
Ontario Institute for Studies
in Education
Department of Curriculum
252 Bloor Street West
Toronto, Ontario
Canada
M5S IV6
Telephone 1-416-923-6641
Fax 1-416-926-4725
JNYOFYOUNG@OISE.UTORONTO.CA

Dr. Eunice Okeke
University of Nigeria
Dept. of Women Studies
Institute of Education
Nsukka
Nigeria
Telephone 234-042-770298
Fax 234-042-770644

BEST COPY AVAILABLE

Dr. Regina Papa
Alagappa University
Department of Women's Studies
Karaikudi - 623 003
Tamil Nadu
India
2861

Lesley Parker
SMEC, Curtin University
GPO Box U1987
Perth, WA 6001
Australia
Telephone 61-9-351-7896
Fax 61-9-351-2503
IPARKERL@INFO.CURTIN.EDU.AU

Sharon Parsons
San Jose State University
Division of Teacher Education:
Science
One Washington Square
San Jose, California
U.S.A.
95192-0074
Telephone 1-408-924-3734
Fax 1-408-924-3713
S.PARSONS@SJSU.VMI.Bitnet

Ellen Passmore
Ontario Women's Directorate
2 Carlton Street, 12th Floor
Toronto, Ontario
Canada
M5B 2M9
Telephone 1-416-314-0350
Fax 1-416-314-0256

Angela Patterson
Candian International
Development Agency
200 Promenade du Portage
Hull, Quebec
Canada K1A 0G4
Telephone 1-819-953-4268
Fax 1-819-953-3348

Carla Pieterson
58-60 Fiddlers Green Road
London, Ontario
Canada
N6H 4S7
Telephone 1-519-473-2520

Hon. Penny Priddy
Ministry of Women's Equality
Parliament Buildings
Victoria, British Columbia
Canada
V8V IX4
Telephone 1-604-387-1123
Fax 1-604-387-4312

Leonie Rennie
SMEC, Curtin University
GPO Box U1987
Perth, WA 6001
Australia
Telephone 61-9-351-7896
Fax 61-9-351-2503
IRENNIEL@INFO.CURTIN.EDU.AU

Pam Roper
Women's Bureau, Labour Canada
165 Hotel de Ville
7th Floor
Hull, Quebec
Canada
KIA OJ2
Telephone 1-819-994-0911
Fax 1-819-997-0126

Lionel Rudd
School of Engineering
Laurentian University
Ramsey Lake Road
Sudbury, Ontario
Canada
P3E 2C6
Telephone 1-705-675-1151

Jan Schmitz
1319A 11th Street East
Saskatoon, Saskatchewan
Canada
S7H OG4
Telephone 1-306-343-5791

Gilda Segal
Sydney University of Technology
PO Box 222
Lindfield, NSW 2070
Australia
Telephone 61-3-305-264
Fax 61-3-305-556

Michelle Rosynsky
Douglass Project Rutgers Women
in Math, Science & Engineering
Douglass College
P.O. Box 270
New Brunswick, New Jersey
U.S.A.
08903-0270
Telephone 1-908-932-9197
Fax 1-908-932-1533

Heather Ryan
Education Psychology
University of Alberta
6-102 Education N
Edmonton, Alberta
Canada
T6G 2G5
Telephone 1-403-662-2442

Anne-Marie Scholer
Pine Manor College
61 Parsons Street
Brighton, MA
U.S.A.
02135
Telephone 1-617-783-9867

Cathleen Sekwao
Dar Es Salaam Technical College
P.O. Box 2958
Dar Es Salaam
Tanzania
Telephone 255-51-28331

Laura Selleck
Council of Ontario Universities
444 Yonge Street, Suite 203
Toronto, Ontario
Canada
M5B 2H4
Telephone 1-416-979-2165
Fax 1-416-979-8635

Barbara Sherriff
University of Manitoba
Faculty of Science
Winnipeg, Manitoba
Canada
R3T 2N2
Telephone 1-204-474-8231
Fax 1-204-261-7548
SHERIFF@CCM.UMANITOBA.CA

Dr Doris Simonis
Kent State University
404 White Hall
Kent, Ohio
U.S.A.
44242-0001
Telephone 1-216-672-2580
Fax 1-216-672-3407

Linda Skidmore
Committee on Women in Science
and Engineering
National Research Council
2101 Constitution Ave. NW
Room TJ1000/2011
Washington, DC
U.S.A.
20418
Telephone 1-202-334-1372
Fax 1-202-334-2753
LSKIDMOR@NAS.EDU

Annette Sharp
Westlake Girls High School
2 Wairau Rd., Takapuna
Auckland, 9,
New Zealand
Telephone 09-489-4169
Fax 09-486-1860

Lisa Sicoli
University of Western Ontario
Faculty of Education
12 Thackerey Place
London, Ontario
Canada
N6G 3E7
Telephone 1-519-472-5493

Barbara Simpson
Gustavus Adolphus College
St. Peter, MN
U.S.A.
56082
Telephone 1-507-933-7416
Fax 1-507-933-7041

Gillian Smith
Suffolk County Council
St Andrew House County Hall
Education Department
Ipswich, Suffolk
England
IPI ILJ
Telephone 0473-264607
Fax 0473-281104

Jillian Spink
Technical Vocational Education
Initiative
11 Cranbrook Drive
Esher Surrey
England
KT10 8DL
Telephone 0256-840710
Fax 0256-811634

Else-Marie Staberg
UMEA University
Dept. of Education
S-90187 Umeå
Sweden
Telephone 46-0-90-166211
Fax 46-0-90-166203

Kareen Sturgeon
Linfield College
Biology Department
McMinnville, Oregon
U.S.A.
97128
Telephone 1-503-472-4121
Fax 1-503-472-3198
KSTURG@LINFIELD.EDU

Pearl Suite
c/o Vezina Secondary School
Attawapiskat, Ontario
Canada
POL IA0
Telephone 1-705-997-2114
Fax 1-705-997-2357

Jean Surry
Open Doors of Greater London
87 Wakefield Cres
London, Ontario
Canada
N5X IZ6
Telephone 1-519-453-2986
Fax 1-519-452-3967

Hlezipi Sy
University of Manitoba
2 - 1650 Pembina Hwy
Winnipeg, Manitoba
Canada
R3T 2G3
Telephone 1-204-261-4158
Fax 1-204-944-9918

Helene Sørensen
The Royal Danish School of
Education Studies
Emdrupvej 115 B
2400, Copenhagen N V
Denmark
Telephone 45-39696633
Fax 45-39660083

Karen Tarr
Dakota Collegiate Institute
11 Balsam Place
Winnipeg, Manitoba
Canada
R2H IK8
Telephone 1-204-261-3672

BEST COPY AVAILABLE

Joy Teague
Faculty of Social Sciences
Deakin University
Geelong, Victoria 3217
Australia
Telephone 61-5-227-1413
Fax 61-5-227-2021
JOYT@DEAKIN.EDU.AU

Richard Tessman
McLean Media
19 Locke Lane
Mill Valley, California
U.S.A.
94941-2112
Telephone 1-415-388-1709
Fax 1-415-388-1731

Sheila Tobias
724 North Campbell Avenue
Tucson, Arizona
U.S.A.
85719
Telephone 1-602-628-1105
Fax 1-602-882-6973

Dorothy Tovell
WISEST
Dept. of Medical Microbiology
Medical Science Building
University of Alberta
Edmonton, Alberta
Canada T6G 2H7
Telephone 1-403-492-1842
Fax 1-403-492-8231

Diane Tremblay
Social Sciences and Humanities
Research Council of Canada
350 Albert Street
P.O. Box 1610
Ottawa, Canada
KIP 6G4
Telephone 1-613-992-3409
Fax 1-613-992-1787

Marie-Lyne Tremblay
Secretariat d'Etat
15 Eddy, 10e etage, Salle IOFI
Hull, Quebec
Canada KIA OM5
Telephone 1-819-994-5450

Peggy Tripp-Knowles
Lakehead University
Dept. of Biology and Forestry
Thunder Bay, Ontario
Canada
P7B 5EI
Telephone 1-807-343-8245
Fax 1-807-343-8116
PTRIPPKN@CS-ACAD-LAN.LAKEHEADU.CA

Bernard Vadnais
Service des ressources humaines
Ecole Polytechnique
Case postale 6079
Succursale A
Montreal, Quebec
Canada H3C 3A7
Telephone 1-514-340-3255
Fax 1-514-340-3250

Dr. Shirley Van Hoof
Ontario Advisory Council on
Disabled Issues
988 Lorne Avenue
London, Ontario
Canada
N5W 3L3
Telephone 1-519-659-1411
Fax 1-519-659-4966

Suzanne Veit
Ministry of Women's Equality
Parliament Buildings
Victoria, British Columbia
Canada
V8V IX4
Telephone
Fax1-604-356-9268

Monique Volman
University of Amsterdam
SCO - Uohnstamm Institute
Grote Bichersstraat 72
Amsterdam
The Netherlands
1013 KS
Telephone 3120-5550324
Fax 3120-6242005
Monique Volman
@sco.uva.nl

Rosemarie Volpe
Centre for Student Development
& Counselling
Ryerson Polytechnical Institute
350 Victoria Street
Toronto, Ontario
Canada
M5B 2K3
Telephone 1-416-979-5195

Tami Wall
Association of Professional
Engineers
2255 13th Avenue
Regina, Saskatchewan
Canada
S4P 0V6
Telephone 1-306-525-9547
Fax 1-306-525-0851

Margaret Waller
John Abbott College
P.O. Box 2000
Ste-Anne-de-Bellevue, Quebec
Canada
H9X 3L9
Telephone 1-514-457-6610
Fax 1-514-457-4730

Dr Anne Walton
86 Leiston Road
Aldeburgh, Suffolk
United Kingdom
IP15 5PS
Telephone 0728-453685

Vicky Webber
615 Mayfield Avenue
Stanford, California
U.S.A.
94305
Telephone 1-415-321-5323
VWEBBER@LELAND.STANFORD.EDU

Hanna Westberg
Arbetslivscentrum/The Swedish
Center for Working Life
Box 5606
Stockholm, Sweden
114 86
Telephone 46-0-87-909641
Fax 46-0-81-06851

Karen Wheeler
Ministry of Education and
Training
Policy and Programs Branch
10th Floor, Mowat Block
Toronto, Ontario
Canada M7A IL2
Telephone 1-416-325-2890
Fax 1-416-325-2898

Stella Williams
Obafemi Awolowo University
P.O. Box 1058
Ile Ife, Osun State
Nigeria
Telephone 234-362-32986
Fax 234-126-37547

Lynette Willoughby
Leeds Metropolitan University
Faculty of Information &
Engineering Systems
The Grange, Beckett Park
Leeds
United KingdomLS6 3QS
Telephone 532-832600
Fax 532-833182
L.WILLOUGHBY@UK.AC.LMU

Janet Wood
Department of Microbiology
University of Guelph
Guelph, Ontario
Canada
NIG 2WI
Telephone 1-519-824-4120
Fax 1-519-837-1802

Sarah Zamin
Ministry of Education and
Training
285 Weber Street North
Waterloo, Ontario
Canada
N2J 3H8
Telephone 1-519-571-6009
Fax 1-519-571-6047

Dr. Valentina Zlenko
Academy of Sciences of Ukraine
Institute of World Economy and
International Relations
5 Leontovitch Str.
Kiev
Ukraine 252030
Telephone 044-225-70-87
Fax 044-225-70-22

Marlies Zonneveld
University of Botswana
Private Bag 0022
Gaborone
Botswana
Telephone 351151 (office)
Fax356591

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10:30			Break	Break 10:30 - 10:45	Break	Break 10:15 - 10:45
11:00		Break	Session 4	Session 7 10:45 - 12:15	Session 9 11 - 12	Session 12 10:45 - 12:15
11:30		Home groups				
12:30		Lunch	Barbecue Lunch	Box lunch 12:15 Afternoon Excursions	Lunch 12:15 Video Launch	Lunch and Call to Action
1:30	Registration during Afternoon	Session 2	Session 5			Home Groups
2:00					Session 10	
3:00		Break	Break			Leave taking and Wrap up
3:30		GASAT Biennial General Meeting	Home Groups		Break	
4:00					Home groups	
5:00		Free time/ Interest Groups	Free time/ Interest Groups		Free time	
5:30	Reception	Reception			Reception	
6:30	Dinner	Minister's Dinner	Reception and Dinner 7:00	Dinner for those not on trips	Celebration Dinner	
7:30	Welcome Ceremony					
8:00	Home Groups	Feminist Forum	Interest Groups/Videos	Home Groups	International Panel	

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GASAT ASSOCIATION BOARD

Mary Anderson
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European Representative

Gaell Hildebrand
Representative for Australasia

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Indian Representative &
GASAT 8 Convenor

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Alison Baignée, Canada
Executive Secretary

Val Johnston, Canada
Newsletter Editor

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